PUBLICATION NO. 980599

1995
1996
UNIVERSAL TIMER/COUNTERS

FOR INSTRUMENTS WITH 105.1 SOFTWARE

RACAL-DANA

RACAL-DANA INSTRUMENTS INC.
4 Goodyear Street, P.O. Box C-19541, Irvine, CA 92713
Telephone: 714/859-8999, TWX: 910-595-1136, TLX: 67-8341

RACAL-DANA INSTRUMENTS LTD.
Hardley Industrial Estate, Hythe, Southampton, Hampshire, S04 6ZH, England
Telephone: (0703) 843265, FAX: (0703) 848919, TLX: 47600

RACAL-DANA INSTRUMENTS S.A.
18 Avenue Dutartre, 78150 Le Chesnay, France
Telephone: (1) 3-955-8888, TLX: 697 215

RACAL-DANA INSTRUMENTS GmbH.
Hermannstrasse 29, D-6078 Neu Isenburg, Federal Republic of Germany
Telephone: 06102-2861/2, TLX: 412896

RACAL-DANA INSTRUMENTS ITALIA srl.
Via Mecenate 84/A, 20138 Milano MI, Italy
Telephone: (02) 5062767, (02) 5052686, (02) 503444; TLX: 315697

RACAL

PUBLICATION DATE: AUGUST 1986

Copyright © 1986 by Racal-Dana Instruments Inc. Printed in the United States of America. All rights reserved.
This book or parts thereof may not be reproduced in any form without written permission from the publishers.

WARRANTY

Within one year of purchase, Racal-Dana will repair or replace your instrument, at our option, if in any way it is defective in material or workmanship. The instrument must be returned to the country of purchase, unless prior arrangement has been made, and Racal-Dana Instruments will pay all parts and labor charges. Just call Racal-Dana Customer Service at (714) 859-8999 in U.S.A., (0703) 843265 in England, (1) 3-955-8888 in France, 06102-2861/2 in Germany or (02) 5062767, 5052686, or 503444 in Italy for assistance. We will advise you of the proper shipping address for your prepaid shipment. Your instrument will be returned to you freight prepaid.

PROPRIETARY NOTICE

This document and the technical data herein disclosed, are proprietary to Racal-Dana Instruments, Inc., and shall not, without express written permission of Racal-Dana Instruments, Inc., be used, in whole or in part to solicit quotations from a competitive source or used for manufacture by anyone other than Racal-Dana Instruments, Inc. The information herein has been developed at private expense, and may only be used for operation and maintenance reference purposes or for purposes of engineering evaluation and incorporation into technical specifications and other documents which specify procurement of products from Racal-Dana Instruments, Inc.

FOR YOUR SAFETY

Before undertaking any maintenance procedure, whether it be a specific troubleshooting or maintenance procedure described herein or an exploratory procedure aimed at determining whether there has been a malfunction, read the applicable section of this manual and note carefully the **WARNING** and **CAUTION** notices contained therein.

The equipment described in this manual contains voltage hazardous to human life and safety and which is capable of inflicting personal injury. The cautionary and warning notes are included in this manual to alert operator and maintenance personnel to the electrical hazards and thus prevent personal injury and damage to equipment.

If this instrument is to be powered from the AC line (mains) through an autotransformer (such as a Variac or equivalent) ensure that the common connector is connected to the neutral (earthed pole) of the power supply.

Before operating the unit ensure that the protective conductor (green wire) is connected to the ground (earth) protective conductor of the power outlet. Do not defeat the protective feature of the third protective conductor in the power cord by using a two conductor extension cord or a three-prong/two-prong adaptor.

Maintenance and calibration procedures contained in this manual sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures carefully and heed Warnings to avoid "live" circuit points to ensure your personal safety.

Before operating this instrument:

1. Ensure that the instrument is configured to operate on the voltage available at the power source. See Installation Section.

2. Ensure that the proper fuse is in place in the instrument for the power source on which the instrument is to be operated.

3. Ensure that all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If at any time the instrument:

- Fails to operate satisfactorily
- Shows visible damage
- Has been stored under unfavorable conditions
- Has sustained stress

It should not be used until its performance has been checked by qualified personnel.

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_07280

TABLE OF CONTENTS

Section	Title	Page
1.0	**GENERAL INFORMATION**	1-1
1.1	Introduction	1-1
1.2	Summary	1-1
1.3	Specifications	1-1
1.4	Safety	1-17
1.5	Product Support	1-17
1.6	General Description	1-17
1.6.2	Special Functions	1-17
1.6.3	GPIB Interface	1-17
1.6.4	Models 1995/1996-02M	1-17
1.7	Options	1-17
2.0	**INSTALLATION**	2-1
2.1	Introduction	2-1
2.2	Unpacking and Inspection	2-1
2.3	Reshipment Instructions	2-1
2.4	Bench Operation	2-1
2.5	Equipment Rack Installation	2-1
2.5.2	Fixed-Mount Option 60 Installation	2-1
2.5.3	Slide-Mount Option 65 Installation	2-3
2.6	Miscellaneous Option Installation	2-12
2.6.1	Rear-Panel Input Option 01	2-12
2.6.2	High-Stability Oven Oscillator Option 04E	2-15
2.7	Power Connections	2-16
2.7.2	Line Voltage Selection	2-16
2.7.3	Power Cord and Grounding	2-17
2.8	Storage and Temperature	2-18
2.9	Functional Check	2-18
2.9.1	Introduction	2-18
3.0	**LOCAL OPERATION**	3-1
3.1	Introduction	3-1
3.2	General Operating Information	3-1
3.2.2	Power-On and Self Test	3-1
3.2.3	Home State	3-1
3.2.4	Main Display	3-2
3.2.5	Keyboard Organization	3-2
3.3	Panel Descriptions	3-3
3.3.1	Front Panel Features	3-3
3.3.2	Rear Panel Features	3-14
3.4	Operating Procedures	3-15
3.4.1	Measurement Functions	3-15
3.4.2	Trigger Level Setting	3-27
3.4.3	Gate Time and Resolution	3-29
3.4.4	Delay Mode	3-29
3.4.5	Arming/Gating Selection	3-30
3.4.6	Math Function (R-X)Y/Z	3-30
3.4.7	Statistical Functions/(n) Samples	3-31
3.4.8	Special Functions	3-32
3.4.9	Error Codes	3-35

TABLE OF CONTENTS (Cont'd)

Section	Title	Page
4	SYSTEM OPERATION	4-1
4.1	General Purpose Interface Bus	4-1
4.1.1	Introduction	4-1
4.2	GPIB Description	4-2
4.2.3	GPIB Handshake	4-5
4.3	GPIB Address Assignment	4-8
4.4	Interface Message Repertoire and Response	4-11
4.4.1	Introduction	4-11
4.4.2	Listen and Talk Address Commands	4-11
4.4.3	Addressed and Universal Commands	4-11
4.5	GPIB Operating Modes	4-14
4.5.1	Introduction	4-14
4.5.2	Talk-Only Mode	4-14
4.5.3	Addressed Mode	4-15
4.6	Output Message Format (Talker)	4-15
4.6.1	Introduction	4-15
4.7	Service Request (SRQ) Status Byte	4-20
4.7.1	Introduction	4-20
4.8	Input Commands (Listener)	4-21
4.8.1	Introduction	4-21
4.8.2	Device-Dependent Commands	4-22
4.9	GPIB Errors	4-37
5	PERFORMANCE TESTS & CALIBRATION	5-1
5.1	Performance Tests	5-1
5.2	Required Equipment for Performance Tests	5-1
5.3	Performance Test Procedures	5-3
5.4	Calibration	5-22
5.5	Required Equipment for Calibration	5-22
5.6	Calibration Procedure	5-22
5.7	Verification Procedure	5-23
5.8	Internal Reference Adjustment	5-23
5.8.3	Reference Oscillator Frequency Check	5-24
5.8.4	Adjustment Procedure	5-24
6	DRAWINGS	6-1
7	PARTS LIST	7-1

LIST OF ILLUSTRATIONS

Figure	Title	Page
1.1	Models 1995/1996 Universal Timer/Counter (1996 Shown)	viii
2.1	Fixed-Mount Angle-Bracket Detail	2-2
2.2	Rear Corner Foot, Side Panel, and Handle Detail	2-4
2.3	Loading the Alignment Blocks	2-5
2.4A/B	Slide-Mount and Bracket Assembly	2-7
2.5	Rear End Slide-Mount Rack Dimensions	2-9
2.6	Slide-Mount and Instrument Assembly (with inset)	2-11
2.7	Rear-Panel Input (Option 01) Installation	2-14
2.8	Option 04E Installation	2-15
2.9	AC Line Voltage Selection	2-17
3.1	Trigger Level Setting	3-27
4.1	GPIB Connector (Rear Panel)	4-1
4.2	Interface Signal Pin Assignments	4-2
4.3	Handshake Sequence	4-6
4.4	Handshake Flow Chart	4-7
5.1	Internal Reference Adjustment Setup	5-24

LIST OF TABLES

Table	Title	Page
1.1	1995/1996 Specifications	1-2
3.1	Front-Panel Controls, Indicators, and Connectors	3-4
3.2	Rear-Panel Controls and Connectors	3-14
3.3	Frequency Measurement	3-16
3.4	Period Measurement	3-17
3.5	Time Interval Measurement	3-18
3.6	Total A by B Measurement	3-19
3.7	Manual Totalize Measurement	3-20
3.8	Ratio A/B and C/B Measurements	3-21
3.9	Positive/Negative Pulse Width Measurements	3-22
3.10	Rise A/Fall A Measurements	3-23
3.11	Phase A rel B Measurement	3-24
3.12	Duty A Measurement	3-25
3.13	Slew A Measurement	3-26
3.14	Special Functions (SFs)	3-33
3.15	Error Codes	3-35
3.16	Non-Vol Memory Locations	3-37
4.1	IEEE-488-1978 Standard Interface Subset Capability	4-4
4.2	1995/1996 GPIB Addresses and Talk/Listen Codes	4-9
4.3	Addressed and Universal Commands	4-12
4.4	Measurement and "One-Time" Output Formats	4-16
4.5	Basic 23-Byte Output Format	4-18
4.6	Alpha Header Output Codes	4-19
4.7	High Speed Data (ASCII) Output	4-20
4.8	Status Byte Format	4-21
4.9	Valid Terminators	4-22
4.10	Counter Initialize Code	4-22
4.11	Numerical Input Format	4-23
4.12	Measurement Function Codes	4-24
4.13	Predefined (Forced) Front-Panel Settings	4-27
4.14	Valid Channels for External Arming/Gating	4-28
4.15	Math Codes	4-29
4.16	Memory Codes	4-29
4.17	Statistics Codes	4-30
4.18	Gate/Delay Codes	4-31
4.19	Input Control Codes	4-32
4.20	Arming Codes	4-33
4.21	Learn Codes	4-33
4.22	Measurement Mode Codes	4-33
4.23	Miscellaneous Codes	4-34
4.24	Calibration Codes	4-36
4.25	GPIB Error Messages and Codes	4-37
5.1	Required Test Equipment for Performance Tests	5-2
5.2	Input A Sensitivity Performance Test, I	5-4
5.3	Input A Sensitivity Performance Test, II	5-5
5.4	Input B Sensitivity Performance Test, I	5-6
5.5	Input B Sensitivity Performance Test, II	5-7
5.6	Input C Sensitivity Performance Test (1996)	5-8
5.7	Period A Performance Test	5-9
5.8	Time Interval A→B Performance Test	5-10
5.9	Total A by B Performance Test	5-12

LIST OF TABLES (Cont'd)

Table	Title	Page
5.10	Ratio A/B Performance Test	5-13
5.11	Ratio C/B Performance Test	5-14
5.12	Rise Time Performance Test	5-15
5.13	Fall Time A Performance Test	5-16
5.14	Positive Pulse Width Performance Test	5-17
5.15	Negative Pulse Width Performance Test	5-18
5.16	Phase A rel B Performance Test	5-19
5.17	Duty Cycle A Performance Test	5-20
5.18	Slew Rate A Performance Test	5-21
7.1	List of Suppliers	7-2

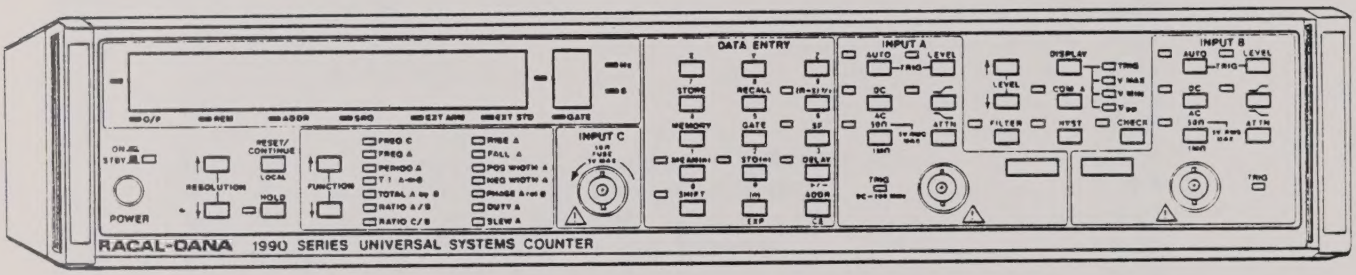


Figure 1.1 - Models 1995/1996 Universal Timer/Counter (1996 Shown)

SECTION 1 GENERAL INFORMATION

1.1 INTRODUCTION

1.1.1 This Instruction Manual provides information for installing, operating, and servicing of Racal-Dana's Universal Systems Counters Models 1995/1996. The designations 1995/1996 are used throughout this manual. Figure 1.1 shows the 1996. Both the 1995/1996 offer universal counter functions using Inputs A and B. The 1996 also provides high-frequency Input C for frequency measurements to 1.3 GHz. Input D, located on the rear panel, provides for external arming and gating. All personnel using the 1995/1996 are encouraged to thoroughly read this manual before operating or servicing either instrument.

1.2 SUMMARY

1.2.1 This manual is organized into eight sections:

SECTION 1. General Information: published specifications, safety considerations, product support, general description, and options.

SECTION 2. Installation: unpacking and initial inspection, reshipment, setup, field installation of options, power connections, storage and ventilation.

SECTION 3. Local Operation: bench operation, including general operating information, panel descriptions, and measurement procedures.

SECTION 4. System Operation: GPIB system operation.

SECTION 5. Performance Tests and Calibration: performance tests and basic calibration on the 1995/1996.

SECTION 6. Drawings: assembly and schematic drawings.

SECTION 7. Parts List: replaceable parts and assemblies.

1.3 SPECIFICATIONS

1.3.1 Table 1.1 lists the 1995/1996 specifications. They specify the performance standards to which either instrument should be tested during necessary calibration and servicing.

Table 1.1 - 1995/1996 Specifications

GENERAL DESCRIPTION

The 1995/1996 system universal counter utilizes a microprocessor-controlled multiple register data acquisition IC for counting and timing to 200 MHz (1.3 GHz on the 1996 with Input C). The counter provides the following measurement functions: frequency, frequency ratio, period, 1-ns resolution time interval, automatic pulse parameters (including duty cycle and slew rate), phase, and totalize. Time interval averaging is available via software-derived functions.

The frequency range on Inputs A and B is 0 to 200 MHz; 40 MHz to 1.3 GHz on Input C using an additional board. Trigger levels on Inputs A and B can be set manually via the front panel keypad or via auto-trigger with 50% trigger points. The DC offset component of the input signal may be tracked by auto-triggering in between readings in the manual mode (peak tracking). Use of a timing error correction (TEC) technique permits measurements with 9-digit resolution in one second and a single-shot time-interval resolution to 1 ns.

The counter is housed in a 3.5" high X 19" wide full-rack X 19" deep standard corporate enclosure. Total weight does not exceed 22 lbs (10 kg). Unit is adaptable to rack or bench top use.

INPUT CHARACTERISTICS

Inputs A and B

Channel Input:	Start/stop channels for each input provide common measurements for Input A and Input B.
Frequency Range:	
DC Coupled	0 to 200 MHz
AC Coupled	20 Hz to 200 MHz
Sensitivity, Sine Wave:	25 mV rms to 100 MHz 50 mV rms to 200 MHz
Sensitivity, Pulse (Frequency Mode):	150 mV p-p; 2.5 ns min. width with 75 mV overdrive.
Sensitivity, Pulse (T.I. Mode):	75 mV p-p; 5 ns min. width with 35 mV overdrive.
Hysteresis:	Sensitivity reduces by X 4 (nominally). Dynamic range bandwidth limited to approximately 50 MHz.

Table 1.1 - 1995/1996 Specifications (Cont'd)

Filter:	Independently selectable Input A and Input B; 100 kHz, nominal. Greater than 20 db attenuation from 10-200 MHz.

Note: The Filter and Hysteresis functions may be combined to increase noise immunity.

Dynamic Range (X1):	75 mV to 10V p-p to 25 MHz 75 mV to 5V p-p to 100 MHz 150 mV to 2.5V p-p to 200 MHz
Signal Operating Range (X1):	-5V DC to +5V DC
Crosstalk at 100 MHz:	500 mV rms*

*Sine wave into either input will not trigger the other input.

Triggering:

Trigger Level Ranges:	5, 50, 250V peak (X1, X10, X50)
Trigger Level:	Adjustable to ±100% of input voltage range with a resolution of 0.2% of input range (10 mV on X1). Level is displayed on front panel.
Trigger Slope:	+ or -, selectable with digital hysteresis compensation.
Trigger Level Setting Accuracy (25°C ± 1°C) (X1 range)	± 1% of trigger level ±10 mV
Trigger Level Temperature Coefficient (X1 range)	± .5 mV/°C

Auto-Trigger

Frequency Range:	DC and 30 Hz to 100 MHz (AC or DC Coupled), usable to 200 MHz
Minimum Amplitude:	150 mV p-p
Accuracy of Trigger Level Readout:	Same as "Read Amplitude Peak" accuracy
Response Time:	650 ms typical 1s maximum

Note: The Auto-Trigger function is independent of the input-signal duty cycle.

Table 1.1 - 1995/1996 Specifications (Cont'd)

Coupling:	AC or DC, independently selectable
Impedance:	
High, Separate and Common	1 megohm shunted by 40 pF (nominal)
50 Ohm	50 ohms nominal
Damage Level:	
1 megohm input impedance	X1: 260V (DC + AC rms) DC to 2 kHz $5 \times 10^5/f$ V, 2 kHz - 100 kHz 5V rms, 100 kHz - 200 MHz X10,X50: 260V (DC + AC rms) DC to 20 kHz $5 \times 10^6/f$ V, 20 kHz to 100 kHz 50V rms, 100 kHz to 200 MHz
50 ohm input impedance	5V rms (DC to 200 MHz)
Input C	
Frequency Range:	40 MHz to 1.3 GHz
Sensitivity, Sine Wave:	10 mV rms to 1.0 GHz 100 mV rms to 1.3 GHZ
Dynamic Range:	40 dB to 1 GHz 20 dB to 1.3 GHz
Impedance:	50 ohms nominal, AC-coupled
VSWR	2:1 at 1 GHz
Maximum Operating Input:	1V rms
Maximum Input: (without damage)	7V rms (fuse-protected)
Input D (Gate Control Input)	
Sensitivity, Pulse:	300 mV p-p; 50 ns min. width with 150 mV overdrive

Table 1.1 - 1995/1996 Specifications (Cont'd)

Impedance:	10 kilohms shunted by ≤35 pF
Damage Level:	± 20V (DC + AC peak)
Triggering	
Trigger Levels:	TTL or zero-crossing, selectable via special function or through GPIB interface
Trigger Slope:	+ or -, selectable via special function or GPIB
FREQUENCY MEASUREMENT	
Inputs A & B	
Range:	
Input A: (B selectable through Special Function 21 or GPIB)	0 to 200 MHz
LSD Displayed:	(1 ns/Gate Time) X Frequency (i.e., 9 digits in one second)
Resolution:	±(1 X LSD) ± 1.4 X (Trigger Error*/Gate Time) X Frequency
Accuracy:	± Resolution ± Time Base Error x Frequency
Gate Time:	
Range:	Selectable from 200 ns to 100 sec.
Resolution:	≥1 ms, 0.1% <1 ms, 0.1 µs
Input C (1996 only)	
Range:	40 MHz to 1.3 GHz
LSD Displayed:	(1 ns/Gate Time) X Frequency
Resolution:	(LSD)
Accuracy:	± Resolution ± Time Base Error x Frequency

* Refer to Definitions, Trigger Error

Table 1.1 - 1995/1996 Specifications (Cont'd)

PERIOD MEASUREMENT	
Range:	5 ns to 1.0 X 10^7 s
LSD Displayed:	(1 ns/Gate Time) X Period
Resolution:	± (1 X LSD) ± 1.4 X (Trigger Error*/Gate Time) X Period
Accuracy:	± Resolution ± Time Base Error x Period
TIME INTERVAL MEASUREMENT	
Input Configuration:	
Separate:	Input A start/Input B stop Input B start/Input A stop (through Special Function 21 or GPIB)
Common:	Input A or Input B start and stop
Range:	-3 ns to 1.0 X 10^7 sec
LSD Displayed:	1 ns (100 ps using Average mode)
Resolution:	± (1 X LSD) ± (Start Trigger Error*) ± (Stop Trigger Error*)
Accuracy:	± (Resolution) ± (Time Base Error) X TI ± (Trigger Level Timing Error**) ± 2ns
Time Interval Delay:	Programmable 200 ns to 100 s
Delay Resolution:	≥1 mSec, 0.1% <1 mSec, 0.1 μs
Delay Accuracy:	Same as Delay Resolution
RISE/FALL TIME	
Range:	5 ns to 25 ms
Minimum Pulse Height:	250 mV p-p
Minimum Pulse Width:	15 ns at signal peaks

* Refer to Definitions, Trigger Error
** Refer to Definitions, Trigger Level Timing Error

Table 1.1 - 1995/1996 Specifications (Cont'd)

LSD Displayed:	Same as Time Interval Specification
Resolution:	Same as Time Interval Specification
Accuracy:	Same as Time Interval Specification with Trigger Level Timing Error** computed at 10% and 90% trigger points
PULSE WIDTH	
Range:	5 ns to 33 ms (10^7 s for manually set trigger levels)
LSD Displayed:	Same as Time Interval Specification
Resolution:	Same as Time Interval Specification
Accuracy:	Same as Time Interval Specification with Trigger Level Timing Error** computed at 50% trigger points
DUTY CYCLE	
Range:	0.01% to 99.99%
Frequency Range:	30 Hz to 100 MHz (to DC for manually set trigger levels)
LSD Displayed:	0.01% or 1 ns/period x 100% (whichever is greater)
Resolution:	$\frac{\text{Pulse Width Resolution}}{\text{Period}} \times 100\%$
Accuracy:	$\pm \text{LSD} \pm \left(\frac{\text{Pulse Width Accuracy}}{\text{Period}}\right) \times 100\%$
SLEW RATE	
Range:	10V/s to 2×10^9 V/s
Transition Time Range:	5 ns to 30 ms
Minimum Pulse Height:	250 mV p-p

** Refer to Definitions, Trigger Level Timing Error

Table 1.1 - 1995/1996 Specifications (Cont'd)

LSD Displayed: $\frac{1\text{ ns}}{\text{Transition Time}} \times \text{Slew Rate (to 3 digits)}$

Resolution: $\pm\left[\frac{(\text{Stop Trig Level}-\text{Start Trig Level}) + 10\text{ mV}}{0.9 \times (\text{Transition Time}-\text{Transition Time Resolution})} - \text{Slew}\right]$

Accuracy: $\pm\left[\frac{(\text{Stop Trig Level}-\text{Start Trig Level}) + 20\text{ mV}}{0.9 \times (\text{Transition Time}-\text{Transition Time Accuracy})} - \text{Slew}\right]$

FREQUENCY RATIO MEASUREMENT

Ratio A/B (software)
(Ratio B/A is available via Special Function 21)

Range:

Input A	0 to 200 MHz
Input B	0 to 200 MHz

Accuracy: $\pm$ (Accuracy of F_A)/F_A $\pm$ (Accuracy of F_B)/F_B

Where F_A and F_B are the frequencies of input signals A and B, respectively.

Ratio A/B (hardware)

Range:

Input A	0 to 100 MHz
Input B	0 to 100 MHz

Table 1.1 - 1995/1996 Specifications (Cont'd)

LSD Displayed: $\frac{\text{Ratio}}{F_A \text{ X Gate Time}}$

Where F_A is the higher frequency, connected to the numerator input

Resolution: $\pm \text{LSD} \pm \frac{T_B \text{ X Ratio}}{\text{Gate Time}}$

Where T_B is the denominator trigger error on lower frequency Input B

Accuracy: Same as Resolution

Ratio C/B (hardware)
(Ratio C/A is available via Special Function 21)

Range:

Input C	40 MHz to 1.3 GHz
Input B	0 to 100 MHz

LSD Displayed: $\frac{\text{Ratio}}{F_C \text{ X Gate Time}} \text{ X } 64$

Where F_C is Input C frequency.

Resolution: $\pm \text{LSD} \pm \frac{T_B \text{ X Ratio}}{\text{Gate Time}}$

Where T_B is denominator trigger error on lower frequency Input B

Accuracy: Same as Resolution

Ratio C/B (software)

Range:

Input C:	40 MHz to 1.3 GHz
Input B:	0 to 200 MHz

Table 1.1 - 1995/1996 Specifications (Cont'd)

Accuracy:	(± Accuracy of F_C/F_C) ± (Accuracy of F_B)/F_B
Where F_C and F_B are the frequencies of input signals C and B, respectively.	
TOTALIZE A BY B	
(Totalize B by A available via Special Function 21)	
Range:	0 to 100 MHz
Start/Stop:	Input B or manual via Special Function 61
LSD Displayed:	1 Count
Resolution:	LSD
Accuracy:	Same as Resolution
PHASE A RELATIVE TO B	
(Phase B relative to A available via Special Function 21)	
Range:	0 to 360°
Minimum Signal:	150 mV p-p using Auto-Trigger function 25 mV rms Manual Trigger settings
LSD Displayed:	Continuous monitoring of measurement provides optimum resolution based on Period and Time Interval Resolution
Resolution:	$\pm$ LSD $\pm \frac{\text{TI Resolution}}{\text{PERIOD A}} \times 360^\circ$
Accuracy:	$\pm$ LSD $\pm \frac{\text{TI Accuracy}}{\text{PERIOD A}} \times 360^\circ$
GATE TIME	
Range:	200 ns to 100 sec
LSD Displayed:	3 Digit Display

Table 1.1 - 1995/1996 Specifications (Cont'd)

TIME BASE (See Option 04E)	
Frequency:	10 MHz
Aging:	<1 ppm per month <2 ppm for first year
Temperature Stability:	± 10 ppm over the range 0° to 50°C, referenced to 25°C
External Standard Input:	
Frequency:	1, 5, 10 MHz
Level:	Min., 500 mV rms, Max., 5V rms
Impedance:	1 kilohm
Internal Standard Output:	
Frequency:	10 MHz
Level:	>1V p-p into 50 ohms
ARMING	
Start Arm:	
Input:	Inputs A, B or D, selectable via Special Functions 82.0-83.3
Start Arm:	(+) or (-) edge, selectable via special function applied to external arm input allows counter to start a measurement cycle

Table 1.1 - 1995/1996 Specifications (Cont'd)

External Gate:	
Input:	Inputs A, B or D, selectable via Special Functions 85.0-88.3
Start Arm:	(+) or (-) edge, selectable via special function applied to external arm input allows counter to start a measurement cycle
Stop Arm:	(+) or (-) edge, selectable via special function applied to external arm input allows counter to stop measurement cycle
Synchronous Window Auto-Trigger: (Syn. Wind. AT)	
Input:	Inputs A, B or D, selectable via Special Functions 91.0-94.3
Start/Stop Edges:	(+) or (-), selectable via special function applied to external arm input allows the auto-trigger function to establish the (+) and (-) signal peaks and trigger level only during the period when the arming signal is present

PEAK SIGNAL MEASUREMENT

The auto-trigger function may be used to determine and indicate the peak maximum, peak minimum, and peak-to-peak values of the measurement signal applied to Inputs A or B.

Display:	Individual 3-digit displays for Inputs A and B.
Frequency Range:	DC and 30 Hz to 25 MHz
Dynamic Range:	.15 to 10V p-p (X1 attenuation)
Resolution:	10 mV (X1 attenuation)
Accuracy:	± 5% of peak-to-peak voltage ± 20 mV for sine waves
	± 2% of peak-to-peak voltage ± 20 mV for pulses > 20-ns wide and ≥ 5 ns rise time

Table 1.1 - 1995/1996 Specifications (Cont'd)

STATISTICS	
Sample Size:	2 to 9999
Standard Deviation:	Displays Standard Deviation of sample size (n)
Average:	Displays Average (mean) value of sample size (n)
Highest:	Using Special Function 51, the highest value in sample size (n) is displayed
Lowest:	Using Special Function 52, the lowest value in sample size (n) is displayed

MATH

Applies to all counting/timing measurement functions. Note Math Function is applied prior to Statistics Function.

$$\text{Display} = \frac{\text{Reading} - X}{Z} Y$$

Where X, Y and Z are constants entered and stored via the keyboard.

Constant (X, Y or Z) Range:	± 0.000000001E-9 to ± 9999999999E9
Power-Up Condition:	X = 0 Y = 1 Z = 1

GPIB INTERFACE

Standard:	IEEE-STD-488-1978
Programmable Controls	All front panel controls with the exception of Power
Universal Commands:	Trigger, Clear, Remote, Local, Local Lockout, Require Service
Data Output Format:	Refer to Tables 4.5 and 4.7
Data Output Rate:	150 readings/second, maximum

Table 1.1 - 1995/1996 Specifications (Cont'd)

NON-VOLATILE MEMORY	
Up to 10 complete front-panel settings may be stored for subsequent recall.	
GATE OUT	
A TTL-compatible signal is provided from a rear-panel BNC connector coincident with the measurement gate + 100 nanoseconds.	
TRIGGER LEVEL OUTPUTS	
Start and stop levels are available on the rear panel from BNC connectors for calibration purposes only.	
DISPLAY	
LED: 10 digit display, character size 0.43". Exponent digit, character size 0.43" When measurement exceeds 10 digits, the least significant 10 digits are displayed, and the overflow indicator is lit.	
TEMPERATURE PERFORMANCE	
Operating Temperature:	$0^{o}C$ to $+50^{o}C$
Storage Temperature:	$-40^{o}C$ to $+75^{o}C$
POWER REQUIREMENTS:	100, 120, 220, 240V rms ± 10% 50 to 400 Hz ± 10% 80 VA
DIMENSIONS:	88.9 mm (3.5 in) High X 427.0 mm (16.8 in) Wide X 475 mm (18.7 in) deep
WEIGHT:	10 kg (22 lb.)

Table 1.1 - 1995/1996 Specifications (Cont'd)

OPTIONS

Option 01 Rear-Panel Inputs

Option 04E High-Stability Oven Oscillator

Proportionally controlled ovenized Internal Frequency Standard

Frequency:	10 MHz
Aging:	$< 5 \times 10^{-10}$ per day at time of shipment
Temperature Stability:	$< 7 \times 10^{-9}$ over the range $0^{\circ}C$ to $50^{\circ}C$
Line Voltage Stability:	$< 5 \times 10^{-10}$ two minutes after a 10% line voltage change

Option 60

Rack mounting kit (fixed)

Option 65

Rack mounting kit (slides)

DEFINITIONS

LSD Least Significant Digit

Trigger Error

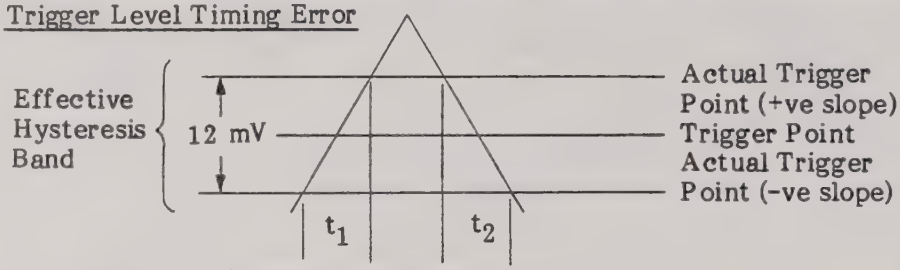
$$\text{Trigger error (Seconds)} = \frac{\sqrt{(e_i^2 + e_n^2)}\ \text{(Volts)}}{\text{Input Slew Rate at Trigger Point (V/sec)}}$$

where e_i = input amplifier rms noise, 250 µV rms max

e_n = input signal rms noise in 250 MHz bandwidth

Table 1.1 - 1995/1996 Specifications (Cont'd)

Trigger Level Timing Error



Timing Error = (Trigger Level Error (V))/
(Seconds) Input Slew Rate at START trig point (V/sec) - (Trigger Level Error (V))/Input Slew Rate at STOP trig point (V/sec)

1.4 SAFETY

1.4.1 The 1995/1996 incorporates a protective earth terminal and is designed to meet international safety requirements. Refer to the safety page "FOR YOUR SAFETY" immediately preceding the Table of Contents. Follow all **NOTES**, CAUTIONS, and WARNINGS to ensure personal safety and prevent damage to the instrument.

1.5 PRODUCT SUPPORT

1.5.1 Racal-Dana supports the 1995/1996 with Product Engineering, Service, and Parts Departments. A complete listing of service centers and field representatives is provided on the last two pages of the manual.

1.6 GENERAL DESCRIPTION

1.6.1 The 1995/1996 is a universal counter designed for system or bench use. Basic measurement functions include Frequency, Period, Time, Ratio, and Totalize. Inputs A and B provide frequency measurement to 200 MHz; Input C (1996 only) extends frequency and ratio measurements to 1.3 GHz. Computational capabilities include Rise/Fall Time, Pulse Width, Phase Measurement, Duty Cycle, Slew Rate, Statistical Data, and Math Operations. Inputs A and B incorporate independent Start and Stop channels with automatic or manual trigger selection. Input D on the rear panel is used for external arming and gating.

1.6.2 Special Functions

1.6.2.1 Both the 1995/1996 provide a set of Special Functions, permitting extended measurements and capabilities beyond the front-panel keyboard. See Subsection 3.4.8 for details.

1.6.3 GPIB Interface

1.6.3.1 The 1995/1996 provides a GPIB interface as standard. This permits the execution of all front-panel operations except power-on and address selection. See Section 4 for GPIB capabilities, addressing, and bus protocol.

1.6.4 Models 1995/1996-02M

1.6.4.1 These two special versions incorporate a MATE(R)/CIIL interface and are available from Racal-Dana.

1.7 OPTIONS

1.7.1 Options available for the 1995/1996 are listed below. Those specified on the original order will be factory installed and ready for use. Section 2 provides information on the field installation of certain options. See the Specifications in Table 1.1 as required.

a. Option 01 - Rear Panel Input
b. Option 04E - High Stability Oven Oscillator
c. Option 60 - Fixed Rack Mount
d. Option 65 - Slide Rack Mount

SECTION 2 INSTALLATION

2.1 INTRODUCTION

2.1.1 This section describes the unpacking and inspection, reshipment, rack installation, miscellaneous option installation, power connections, and storage/temperature requirements for the 1995/1996.

2.2 UNPACKING AND INSPECTION

2.2.1 Before unpacking the counter, check the exterior of the shipping carton for any signs of damage. All irregularities should be noted on the shipping bill. Remove the instrument carefully from its carton, preserving the factory packaging as much as possible. Inspect the counter for any defect or damage. Notify the carrier immediately if any damage is apparent. Have a qualified person check the instrument for safety before use.

2.3 RESHIPMENT INSTRUCTIONS

2.3.1 Use the original packaging if it is necessary to return the counter to Racal-Dana for calibration and/or servicing. The original shipping carton and the instrument's plastic-foam form will provide the necessary support for safe reshipment. If the original packaging is unavailable, reconstruct it as much as possible. Wrap the counter in plastic; then use plastic spray foam to surround and protect the instrument. Reship in either the original or new, sturdy shipping carton.

2.4 BENCH OPERATION

2.4.1 The 1995/1996 is equipped with a tilt-bail to elevate the front of the instrument for easy operation. The tilt-bail is attached to the two front feet on the bottom of the counter. For use, the bail is pulled down to its vertical position.

2.5 EQUIPMENT RACK INSTALLATION

2.5.1 The 1995/1996 can be mounted in a standard 19-inch equipment rack using either the Fixed-Mount Option 60 or Slide-Mount Option 65. Installation instructions for these two options follow.

2.5.2 Fixed-Mount Option 60 Installation

2.5.2.1 Refer to Figure 2.1 for this procedure. The installation package includes:

a. Flange-Mount angle-brackets (2)

b. Front corner-inserts for nonhandle installations (2)

c. Flathead #8-32 x 1/2 screws (4)

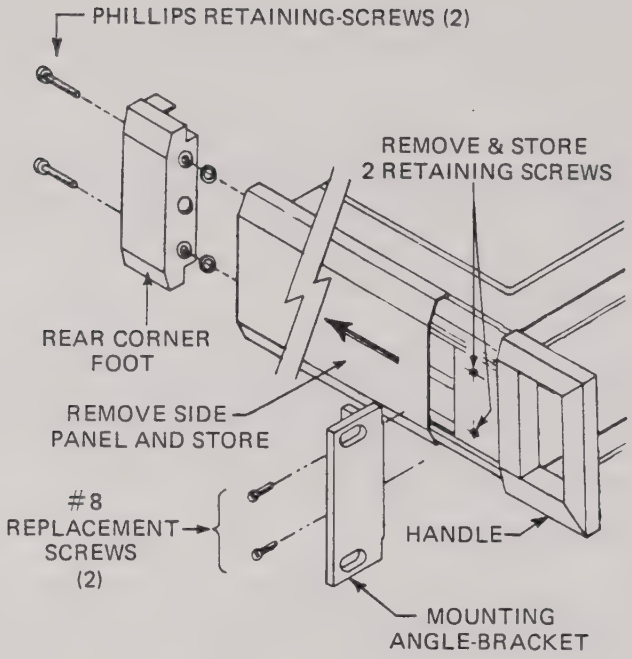


Figure 2.1-Fixed-Mount Angle-Bracket Detail

2.5.2.2 Remove the tilt-bail by applying pressure inward on the bail legs, then unhooking the bail from the bench feet.

2.5.2.3 Remove the bench feet and side panels by completing the following steps:

a. Unscrew the two phillips head screws from each rear corner-foot. This frees the corner-feet, covers, and side panels

b. Remove the two rear corner-feet from the case

c. Place the instrument bottom-up, then slide the bottom cover 1/2 inch towards the rear panel and lift off. The top cover slides off in the same manner

d. Remove the four bench feet from the bottom cover by unscrewing the phillips head retaining screws from each foot

e. Slide the side panels down their retaining tracks towards the rear, then remove the panels. (With side panels off, the retaining screws-2 per side-for the front handles/corner inserts are exposed.)

2.5.2.4 Install the flange-mount angle-brackets by completing the following steps:

a. Remove the retaining screws for both handles/corner inserts, leaving the handles/corner inserts in place

b. Place an angle bracket over each handle/corner insert, aligning the mounting holes over the retaining screw holes

c. Insert two replacement flathead #8-32 x 1/2 screws through each angle bracket and handle/corner-insert combination, then screw securely to the case

2.5.2.5 Reassemble the instrument by replacing the top and bottom covers, fitting the front edge of the covers into the groove in the front panel. Do not attempt to replace the instrument's side panels. Complete the procedure by screwing the two rear corner-feet to the case.

2.5.2.6 Store the following items in a convenient location:

Two side-panels, four bench feet and retaining screws, and four replaced retaining screws from the front handles/corner inserts.

2.5.3 Slide-Mount Option 65 Installation

2.5.3.1 Refer to Figures 2.2-2.6 for this procedure. The installation package includes:

a. Front corner-inserts for nonhandle installations (2) - P/N 454323

b. Flange-Mount angle-brackets (2) - P/N 454422

c. Alignment blocks (6) - P/N 454490

d. Front rack-brackets (2) - Part of P/N 454488

e. Rear rack-brackets (2) - Part of P/N 454488

f. Triple-rail slide-mount assemblies (2) - P/N 454489

g. Self-Anchoring #10-32 tinnerman nuts (12) - P/N 610920

h. Phillips panhead #10-32 x 1/2 screws (8) - P/N 615091

i. Slotted panhead #8-32 x 3/8 screws with nuts, washers, and lock washers (6 each) - Part of 454488

j. Phillips panhead self-tapping #8-32 x 5/16 screws (8) - P/N 610910

k. Phillips flathead #8-32 x 1/2 screws (4) - P/N 615325

l. Phillips panhead #10-32 x 3/4 screws (4) - P/N 615093

m. Alignment #8 x 1/16 (spacers) washers (2) - P/N 610921

n. Cover retaining-brackets (2) - P/N 454597

o. Phillips Flathead Metric Screws M4 x 12 (4) - P/N 611011

2.5.3.2 Prepare the instrument for installing the alignment blocks in the side channels of the unit. Refer to Figures 2.1 and 2.2 and complete the following steps:

a. Remove the two rear corner-feet by extracting the two phillips retaining screws from each foot

b. Slide the top and bottom covers 1/2 inch towards the rear panel, then lift them off

c. Remove the four bench feet and tilt-bail from the bottom cover

d. Slide the side panels down their retaining tracks towards the rear, then remove the panels

e. Store the four panels, four bench feet, and tilt-bail in a convenient location

f. Remove the two front handles/corner inserts from the frame by extracting the two retaining screws from each handle or corner insert

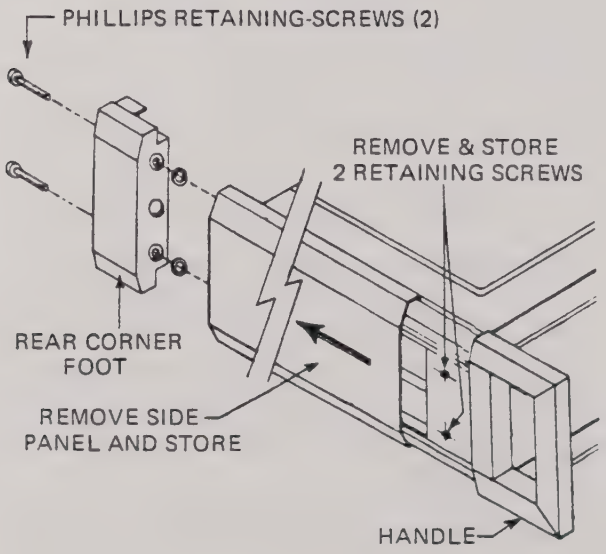


Figure 2.2-Rear Corner Foot, Side Panel, and Handle Detail

2.5.3.3 Refer to Figure 2.3 for alignment block loading. Slide the alignment blocks down the center channel of the frame on each side of the instrument. Three alignment blocks per side should be loaded for full-rack depth units; two blocks for intermediate-rack depth units. The two screw holes in each alignment block should be at center position and below, relative the center channel.

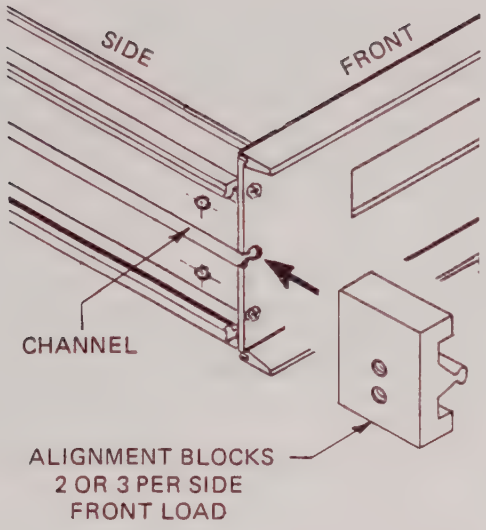


Figure 2.3-Loading the Alignment Blocks

2.5.3.4 Replace the top and bottom covers on the instrument. Fasten the covers using the two cover retaining-brackets (see Figure 2.6) and four phillips panhead screws (two per side) originally removed from the rear corner-feet. The instrument is now ready for attachment of the two triple-rail slide-mount assemblies.

2.5.3.5 Refer to Figure 2.4A/B. Prepare the triple-rail slide-mount assembly for equipment rack installation. First, note that the instrument-rail and rack-rail holes are accessible either directly or through the enlarged holes in the center-rail (as the assembly is extended or retracted). Complete the following procedure:

a. Place a front rack-bracket (with one mounting slot) on the workbench, slotted flange facing down

b. Position the front end (i.e., slide-out end) of the slide-mount assembly over and parallel to the front rack-bracket. The rack-rail should rest within the bracket, about 3/4 inch from the bracket's front edge

c. Adjust the rails, aligning the front rack-rail hole with the center-rail access hole and mounting slot in the front rack-bracket. Insert a slotted panhead #8-32 x 3/8 screw through the holes. Attach a washer, lock washer, and nut to the screw and secure firmly, maintaining the 3/4-inch dimension to the front of the bracket

NOTE

Measure the distance between the front and rear mounting-rails of the rack at this point. If the distance is **less** than 20 inches, follow instruction "d" next; if the distance is **greater** than 20 inches, follow instruction "e".

d. Fully extend the slide-mount assembly. Position a rear rack-bracket (with two elongated mounting slots) on the rear of the assembly in the same way as the front rack-bracket. Align the mounting slot closest to the slotted flange with the rear rack-rail nail hole. Insert a slotted panhead #8-32 x 3/8 screw through the holes. Attach a washer, lock washer, and nut to the screw and secure the rear rack-bracket loosely to the slide-mount assembly

e. Fully extend the slide-mount assembly. Position a rear rack-bracket (with two elongated mounting slots) on the rear of the assembly in the same way as the front rack-bracket. Align the mounting slot farthest from the slotted flange with the rear rack-rail nail hole. Insert a slotted panhead #8-32 x 3/8 screw through the holes. Attach a washer, lock washer, and nut to the screw and secure the rear rack-bracket loosely to the slide-mount assembly

f. Complete the other slide-mount and rack-bracket assembly in the same manner as just described

g. Slide two self-anchoring #10-32 tinnerman nuts on the front and rear rack-brackets at the top and bottom slots of both slide-mount assemblies

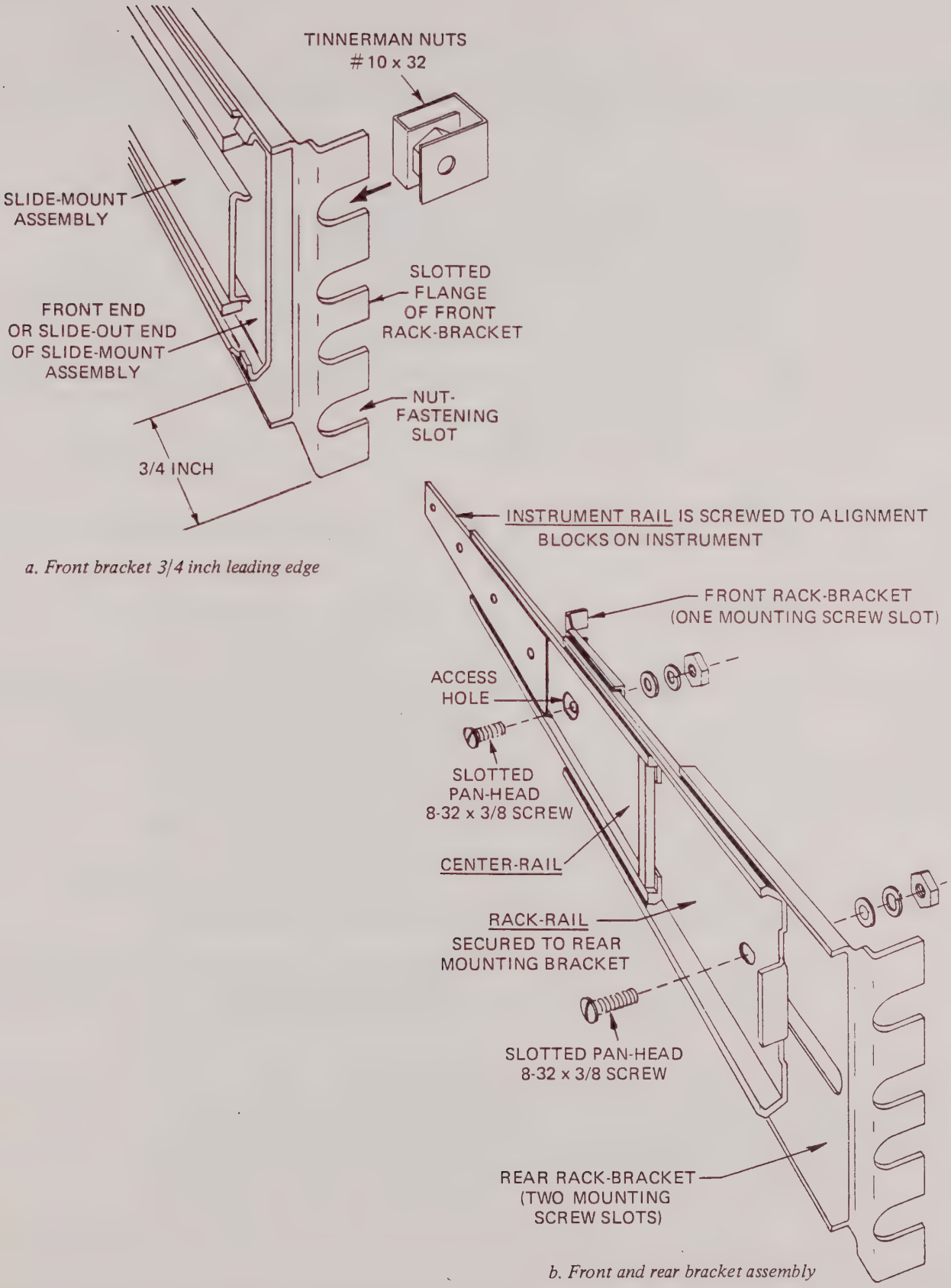

TINNERMAN NUTS
#10 x 32
SLIDE-MOUNT ASSEMBLY
SLOTTED FLANGE OF FRONT RACK-BRACKET
FRONT END OR SLIDE-OUT END OF SLIDE-MOUNT ASSEMBLY
NUT-FASTENING SLOT
3/4 INCH
a. Front bracket 3/4 inch leading edge
INSTRUMENT RAIL IS SCREWED TO ALIGNMENT BLOCKS ON INSTRUMENT
FRONT RACK-BRACKET (ONE MOUNTING SCREW SLOT)
ACCESS HOLE
SLOTTED PAN-HEAD 8-32 x 3/8 SCREW
CENTER-RAIL
RACK-RAIL SECURED TO REAR MOUNTING BRACKET
SLOTTED PAN-HEAD 8-32 x 3/8 SCREW
REAR RACK-BRACKET (TWO MOUNTING SCREW SLOTS)
b. Front and rear bracket assembly

Figure 2.4A/B-Slide-Mount and Bracket Assembly

2.5.3.6 The assistance of a second person will be needed for the following instrument-rack assembly. Secure the slide-mount assembly in the designated area of the instrument rack using the procedure below.

NOTE

If the mounting-rail of the instrument rack is tapped for #10-32 screws, drill out two places for each bracket using a 1/4 inch diameter bit. Proceed with the assembly:

a. Hold the front end of the slide-mount assembly behind the front mounting-rail of the rack, while the second person holds the rear end of the assembly

b. Secure the front rack-bracket to the front mounting-rail using two phillips panhead #10-32 x 1/2 screws. Seat the front rack-bracket firmly against the mounting-rail before tightening these screws

c. Install the other front rack-bracket on the front mounting-rail in the same manner

d. Set the front dimension between the two slide-mount assemblies at 16 5/8 inches

e. Adjust the length of the rear rack-brackets to touch the inside of the rear mounting-rail. Tighten the rear rack-bracket assembly screws

f. The distance between the two slide-mount assemblies at the rear-bracket should be 16 5/8 inches. Should a filler plate be required to secure the slide-mount assembly to the rear rack mounting-rail at 16 5/8 inches, use the dimensions given in Figure 2.5 to determine filler-plate size

NOTE

The rear rack-bracket may require adjustment to accommodate the thickness of the filler plate.

g. Secure the rear rack-bracket to the rear rack mounting-rail (or filler plate) using two phillips panhead #10-32 x 1/2 screws in each bracket

h. The triple-rail slide-mount assemblies should move freely to their maximum extended positions. If not, remove any obstacle before installing the instrument

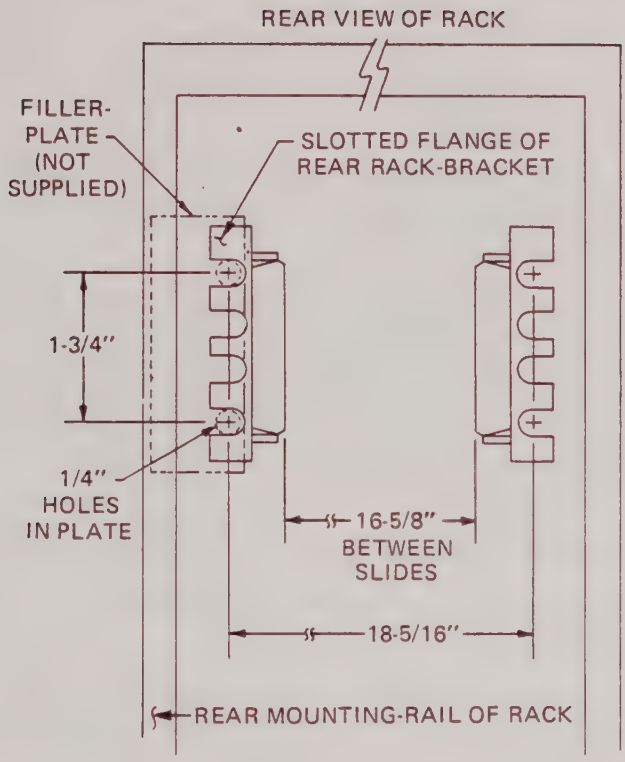


Figure 2.5-Rear End Slide-Mount Rack Dimensions

2.5.3.7 Refer to Figure 2.5 (with inset). The assistance of a second person will be needed for the following slide-mount assembly-to-instrument installation.

a. Extend the rails of the slide-mount assemblies to their maximum position. Insert a phillips panhead self-tapping #8-32 x 5/16 screw inward through the first mounting hole in the instrument-rail. Place an alignment (spacer) washer on the screw on the other side of the instrument-rail

b. Screw the flange-mount angle-bracket to pull-up position on the instrument-rail. Check that the alignment washer remains between the angle bracket and instrument-rail. Repeat this procedure for the other instrument-rail

NOTE

For 5-1/4 inch high instruments, use the **bottom** hole of the angle bracket in step "b" above.

c. With the help of a second person, position the instrument between the fully extended rails. For full-depth instruments, the rear alignment-block hole should be situated immediately behind the fourth attachment hole in the center-rail. For intermediate-depth instruments, the rear alignment-block hole should be located behind the third attachment hole

NOTE

For 3-1/2 inch high instruments, position the rail access hole over the **top** alignment-block hole; for 5-1/4 inch high instruments, use the **bottom** hole.

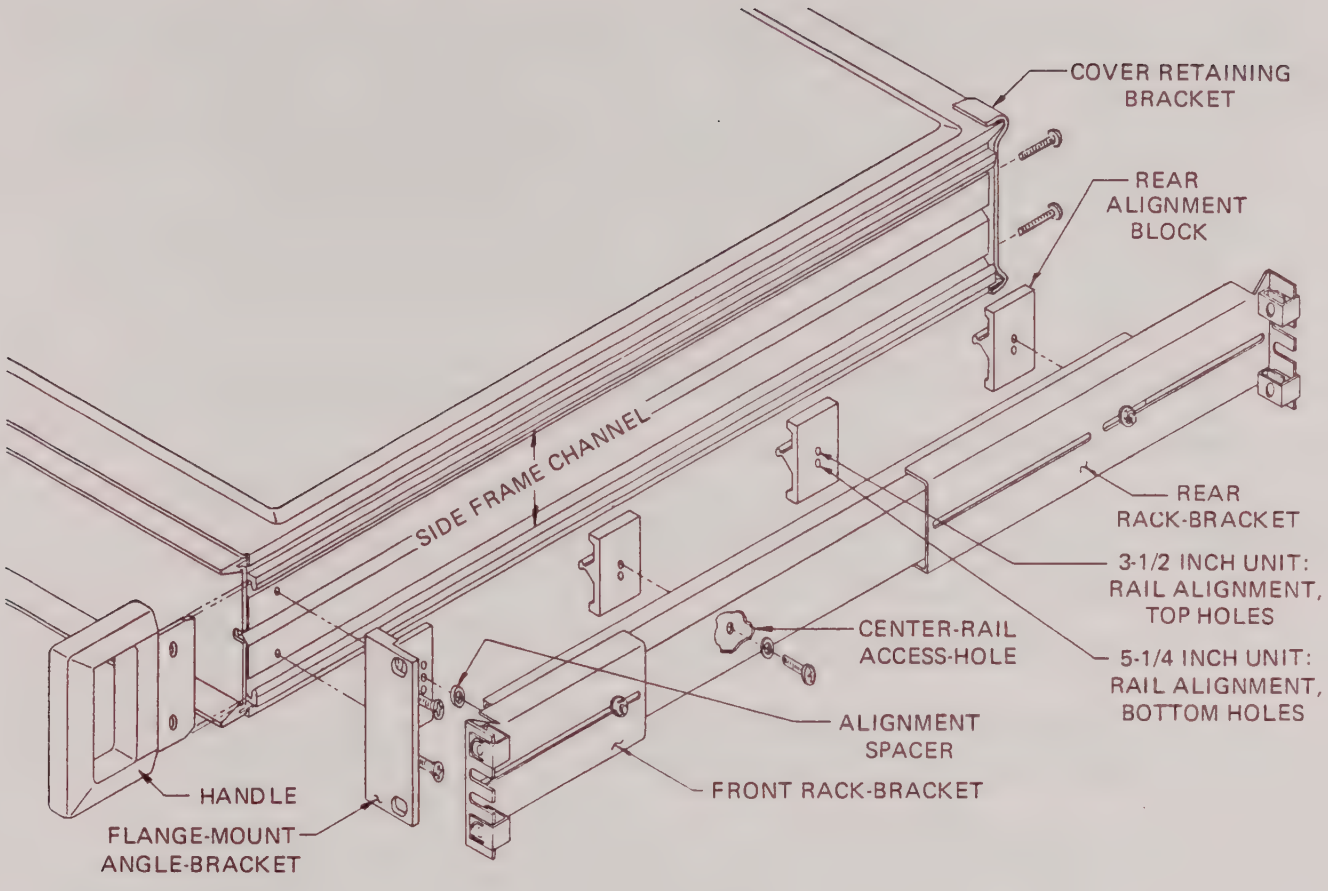
d. Insert a phillips panhead self-tapping #8-32 x 5/16 screw through the rail access hole and screw it to pull-up position in the alignment block. At the same time, position the flange-mount angle-bracket in its approximate final location in the side frame channels. Align the other alignment-block screw holes with their attachment holes in the instrument-rail. Insert phillips panhead self-tapping #8-32 x 5/16 screws in the alignment blocks and fasten to pull-up position. Repeat this procedure for the other rail

e. Slide the handle/corner insert between the side frames and each angle bracket

f. Align the handle/corner insert and angle-bracket holes with their retaining screw holes in the side frame

g. Insert two phillips flathead #8-32 x 1/2 screws (some models use M4 x 12) through the handle/corner insert and angle-bracket combinations, then fasten firmly to the frame

h. Securely fasten all self-tapping screws in the instrument-rail. The instrument should slide freely on the rails



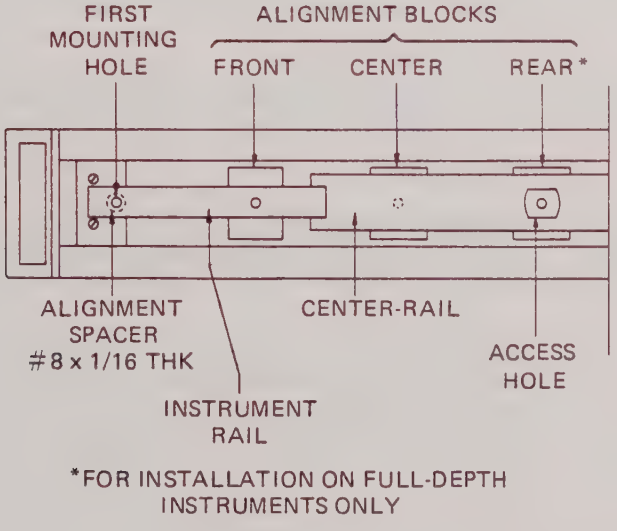


Figure 2.6-Slide-Mount and Instrument Assembly (with inset)

2.5.3.8 The following assembly is required to lock the instrument into its normal operating position on the rack:

a. Slide two self-anchoring #10-32 tinnerman nuts on the mounting-rail of the rack (each side). These nuts should be aligned with the angle-bracket slots. Omit the tinnerman nuts if the mounting-rail is tapped for #10-32 screws

b. Slide the instrument fully into the rack until the angle brackets strike the slide-mount bracket screws. Secure the instrument in place using four phillips panhead #10-32 x 3/4 screws

2.6 MISCELLANEOUS OPTION INSTALLATION

2.6.1 Rear-Panel Input Option 01

2.6.1.1 Refer during this procedure to Figure 2.7A, B, and C as well as Option 01 Assy Drawing 404378 in Section 7. The installation package includes:

a. Rear-Input Option Assy PCB (1)

b. Rear-Input 72-conductor Cable Assy (1)

c. Phillips panhead self-locking #6-32 X .312 screws (9)

d. Metal blind-threaded #6 standoffs (5)

2.6.1.2 Complete the following steps:

a. Loosen, but don't remove, the two rear corner-feet by unfastening the four retaining screws (two per foot). Back the corner feet out approximately 5/8 inch. This permits removal of the top and bottom covers

b. Slide both the top and bottom covers toward the rear of the unit, then lift up and out to remove

c. Turning counterclockwise, remove the lock nuts from the front-panel BNC connectors for INPUTs A and B (attached to the signal conditioner board) and INPUT C

d. Remove the black rear-hole plug from J210 on the 1996. Remove INPUT C's BNC connector with its cable from the front panel and install in J210 on the rear panel of the 1996. Place the rear-hole plug for INPUT C on the front panel

e. Remove the five self-locking screws from the top of the signal conditioner board. These screws fasten the signal conditioner PCB to the motherboard. Set these screws aside

f. On the 1995, disconnect the 2-conductor (black & white, twisted-pair) 10 MHz internal frequency reference and 14-conductor twisted-wire power cables connecting the signal conditioner PCB and motherboard. This involves unplugging P8 from J8 (10 MHz cable) and P6 from J6 (power cable) on the signal conditioner board. In addition, on the 1996, unplug P7 from J7 on the signal conditioner board. This disconnects the other 2-conductor (black & white, twisted-pair) 10 MHz internal frequency reference cable. P17/J17, P18/J18 (1996), and P19/J19 can remain connected on the motherboard during this procedure. Set the free ends of the three disconnected cable assemblies safely aside for later reconnection.

g. Slide the signal conditioner board towards the rear of the instrument; pull the board up and remove, setting it aside

h. Remove the two black rear-hole plugs from J201 and J202 and place them on the front panel

i. Place the Option 01 assembly board into the unit, center slot towards the rear. Connect P9A on the option board and J9 on the motherboard

j. Fasten the option board securely to the motherboard using the existing four short standoffs and four self-locking screws

k. Tip the instrument on its side. Insert and securely fasten the five supplied long metal standoffs to the motherboard using five self-locking screws, inserting them from the bottom of the unit through the motherboard

l. Connect the rear-input option ribbon cable to the option board using plug P9B and socket J9B. Fold the cable halfway back towards the rear of the unit

m. Reverse the signal conditioner board 180^{o} (INPUT A and B connectors towards the rear panel) and hold the board in one hand. Connect the other end of the rear-input option cable to the bottom of the signal conditioner board using plug P9 and socket J9A

n. Align INPUT A and B BNC connectors on the signal conditioner board with their corresponding rear-panel holes, then slide the board so that these connectors protrude through the holes

o. Orient the signal conditioner board so that its five holes align with the five longer standoffs just fastened to the motherboard. Secure the signal conditioner board to these standoffs using the original five self-locking screws, inserting them through the top of the board

p. Secure the BNC connectors for all rear-mounted inputs using their lock nuts.

q. Reconnect the single black & white 10 MHz internal frequency reference (two on the 1996) and power cable assemblies to the signal conditioner board as before

r. Replace the top and bottom covers; firmly secure the two rear corner-feet, completing the installation

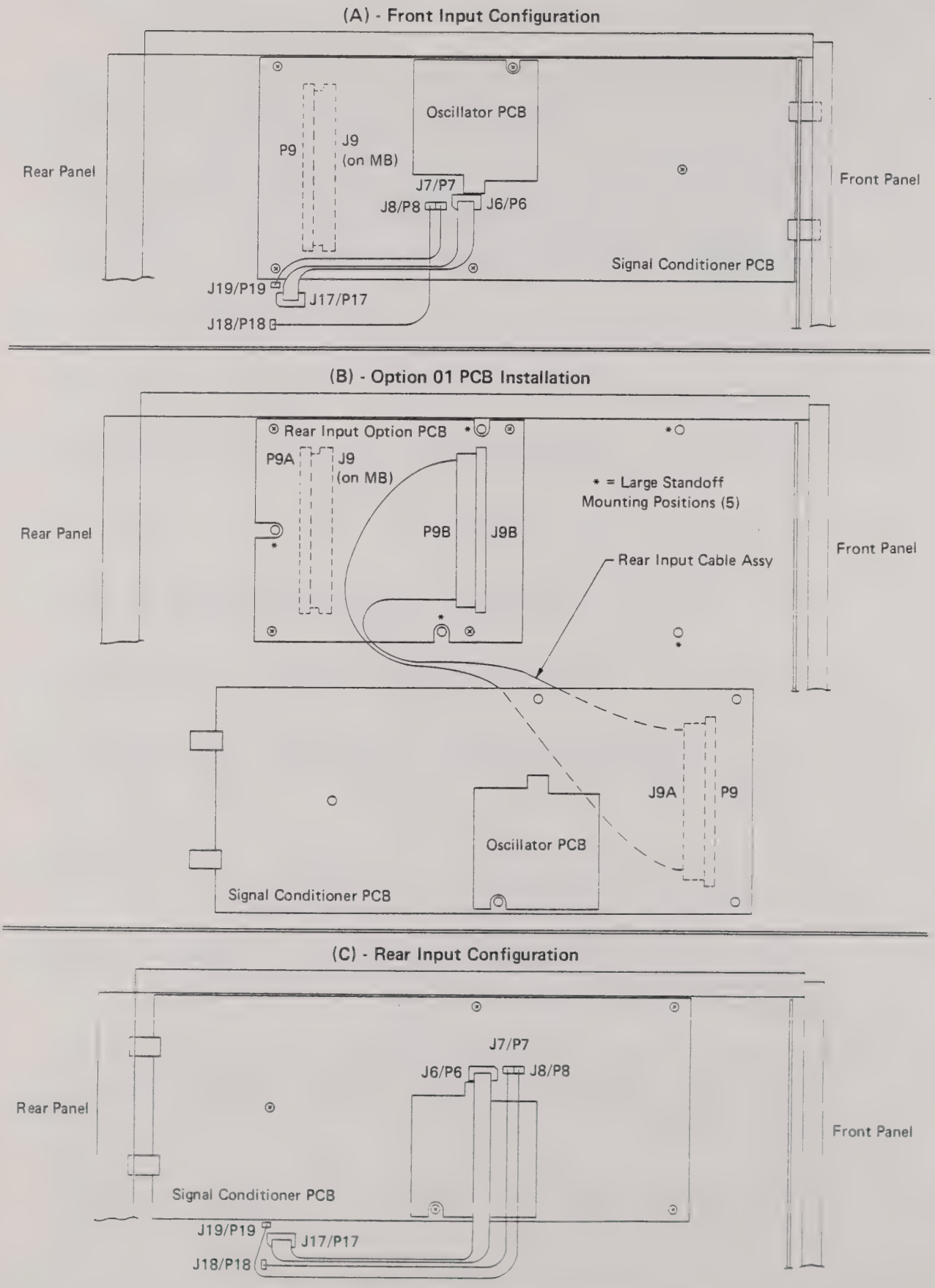


Figure 2.7-Rear-Panel Input (Option 01) Installation

2.6.2 High-Stability Oven Oscillator Option 04E

2.6.2.1 Refer to Figure 2.8 for this procedure. The installation package includes:

a.	Oscillator assembly (1)	P/N 404386 for Option 04E
b.	#4 split lock washers (2)	P/N 617127
c.	#4 flat washers (2)	P/N 617102
d.	M3 x 8 screws (2)	P/N 611067
e.	Cable tie (1)	P/N 610777

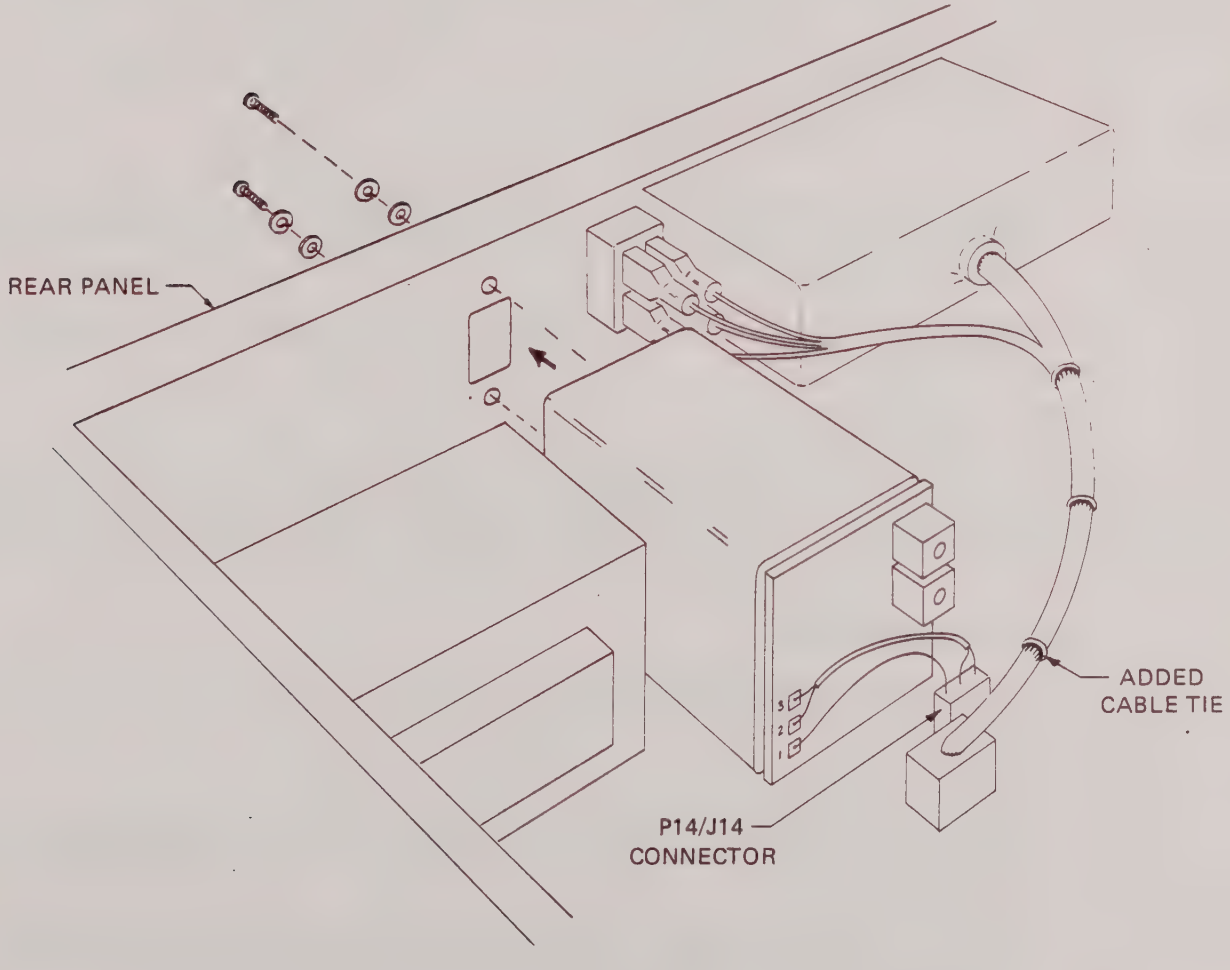


Figure 2.8 - Option 04E Installation

2.6.2.2 Installation

a. Disconnect the AC power cord at the rear panel

b. Loosen, but don't remove, the two rear corner-feet by unfastening the four retaining screws (two per foot). Back the corner feet out approximately 5/8 inch. Slide the top cover toward the rear of the unit, then lift up and out to remove

c. Remove the currently fitted standard 10 MHz oscillator assembly by:

1. Removing the cable tie securing cables to P14/J14 and P13/J13

2. Extracting the two screws and washers attaching the oscillator assembly to the rear panel via the two threaded standoffs

3. Disconnecting the 5-pin connector cable (P14) from the motherboard at J14, then lifting the oscillator assembly out of the chassis

d. Connect the 5-pin connector cable of the option oscillator assembly at J14 on the motherboard

e. Replace the cable tie securing cable to P13/J13

f. Secure the oscillator assembly to the rear panel using the two M3 x 8 screws, two flat washers, and two lock washers. The screws pass directly into the top of the oscillator assembly

g. Replace the top cover; firmly secure the two rear corner-feet, completing the installation

2.7 POWER CONNECTIONS

2.7.1 Before operating the counter, verify that the AC voltage selector is correctly set for the local AC supply. The counter operates on 100, 120, 220, or 240 volts, 50 to 60 Hz. The present voltage range can be seen through the small window in the power input module on the rear panel.

2.7.2 Line Voltage Selection

2.7.2.1 The line voltage setting is easily changed by repositioning the small voltage selector card in its slot. Refer to Figure 2.8 and use the following procedure:

a. Remove the power cord from the power input module

b. Fully slide the transparent fuse cover to the left. This exposes the fuse and voltage selector card

c. Pull the small lever marked FUSE PULL completely to the left. This ejects the fuse from its holder, permitting access to the selector card

d. Remove the selector card, then reposition it in its slot so that the desired line voltage designation is visible. (Using a small pair of needle-nose pliers can be helpful in completing this step.)

e. Pull the lever completely back to the right, snapping it closed

f. Replace the fuse in it holder. Line voltage settings of 100 or 120V should have a 1A Slow-Blow fuse installed; settings of 220 or 240V should have a .5V Slow-Blow fuse installed.

g. Slide the fuse cover completely to the right covering the voltage selector card and fuse. The correct line voltage designation should be visible through the window

h. Connect the power cord to the counter again

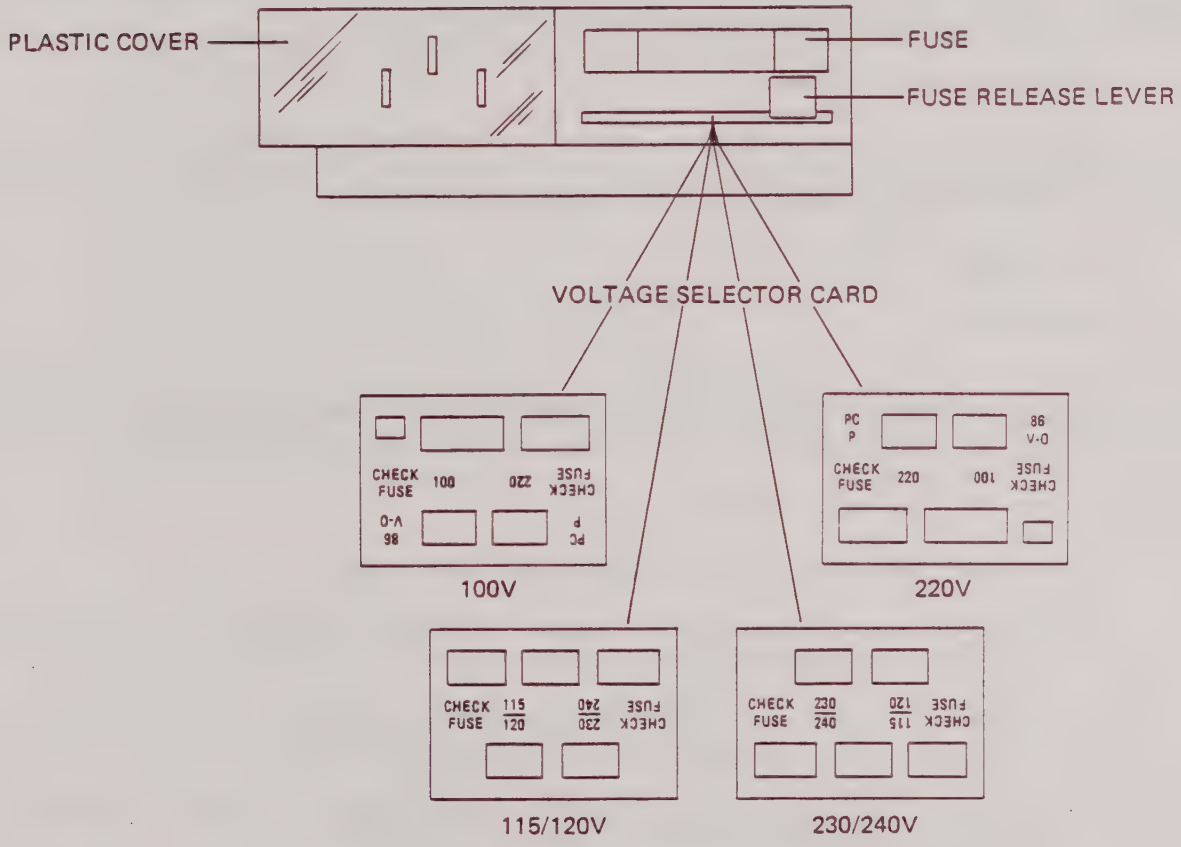


Figure 2.9 - AC Line Voltage Selection

2.7.3 Power Cord and Grounding

2.7.3.1 The front panel and instrument case are grounded in accord with MIL-T-28800C, protecting the user from possible injury due to shorted circuits.

NOTE

Both counters are designed to meet IEC Publication 348, "Safety Requirements for Electronic Apparatus for Class I Instruments."

2.7.3.2 A protective ground terminal, forming part of the rear-panel input socket, is provided. Both counters are supplied with a detachable 3-core power cord. Only this cord should be used.

2.7.3.3 Use only AC power outlets having a protective ground for connection to the counter. **DO NOT USE** 2-core extension cords or 3-prong to 2-prong adapters that don't provide a protective ground connection. Connection of the power cord to the power outlet must be made in accordance with the following standard color code:

	American	European
Live	Black	Brown
Neutral	White	Blue
Ground (Earth)	Green	Green/Yellow

2.7.3.4 Also, all devices connected to or in proximity with the 1995/1996 must maintain the third-wire ground(earth) intact as set forth in current regulations.

2.8 STORAGE AND TEMPERATURE

2.8.1 The 1995/1996 can be stored at temperatures ranging from -40°C to +70°C at 75% relative humidity without adverse effects to PCBs or components. The counter must be brought within its specified operating range of 0°C to +50°C before power-on.

2.9 FUNCTIONAL CHECK

2.9.1 Introduction

2.9.1.1 The following test procedure confirms whether or not the 1995/1996 is performing correctly by checking most of the counter's circuitry. This procedure should be conducted when the 1995/1996 is first put into service and after shipment to a new location.

2.9.1.2 Now perform the following procedure:

a. Connect the 1995/1996 to a suitable AC power supply

b. Turn on the rear-panel power switch. It should illuminate. Confirm that the front-panel POWER (ON/STBY) button is out (⏻) and the STBY LED lit

c. Depress the front-panel POWER (ON/STBY) button to ON, supplying power to the entire counter. Verify that the STBY LED turns off

d. Confirm that the instrument model number "1995" or "1996" is displayed for about two seconds, and then the main display blanks

NOTE:

Home-state conditions for the 1995/1996 are listed in Subsection 3.2.3. Refer as required.

e. Provide a 50Ω coaxial test lead fitted with BNC connectors. This lead should be 60 cm to 1 m long

f. Using the test lead, connect the 10 MHz REF-OUT connector (see Figure 3.2) on the rear panel to Input A's connector

NOTE:

After power-on, the following home-state conditions exist: FREQ A, AUTO-TRIG A, X1, 1 MΩ, AC-coupling, Filter off, and COM A off.

g. Verify that the main display shows 10.000000 ± 1 count E6 Hz; that both the GATE and Input A TRIG LEDs flash

h. Select Input B using key sequence <21> SHIFT STORE SF SHIFT SF. Verify that the SF LED is lit

i. Using the same coaxial test lead, connect the 10 MHz REF-OUT connector to Input B's connector

j. Repeat step g for Input B

k. Toggle the SF key using key sequence SHIFT SF. The SF LED should turn off

l. Disconnect the test lead between the REF-OUT and Input B connectors

m. If the counter is Model 1996, select FREQ C. Connect the test lead between the REF-OUT and Input C connectors

n. Verify that the main display shows 10.000000 ± 1 count E6 Hz and that the GATE LED flashes

3.1 INTRODUCTION

3.1.1 This section contains information for operating the 1995/1996 as a bench instrument. It provides General Operating Information, Front and Rear Panel Descriptions, and Operating Procedures.

3.2 GENERAL OPERATING INFORMATION

3.2.1 If the counter is being used for the first time or at a new location, ensure that the voltage selector is set for the correct local AC supply before turning on the instrument. Refer to Subsection 2.7.2, as required, for details on line voltage selection.

3.2.2 Power-On and Self Test

3.2.2.1 Turn on the rear power switch, placing the counter in the Standby mode. The front-panel STBY LED should be lit if the red POWER-ON button is out (▲). In Standby, power is supplied to the instrument's frequency standard (timebase). This eliminates the need for warmup each time the 1995/1996 is turned on.

3.2.2.2 Depress the POWER-ON/OFF button to its ON (▬) position. Power should now be supplied to the entire counter and the STBY LED should be off.

3.2.2.3 After powering-on, the 1995/1996 executes a programmed self-test of the major internal circuitry. This check verifies normal operation of the counter's microcomputer, counting circuitry, timebase, and ROM memory circuitry. Should a failure occur during this self-test, a numbered error is displayed.

3.2.3 Home State

3.2.3.1 After self-test, the counter reverts to a home state, ready for operation. The following home-state conditions are selected after "self-test":

a. AUTO-TRIG A enabled; AUTO-TRIG B disabled

b. Time Interval DELAY: 1 millisecond. (Verify using key sequence SHIFT RECALL DELAY)

c. GATE Time: ten milliseconds. (Verify using key sequence SHIFT RECALL GATE)

d. Math constants X, Y and Z: 0, 1 and 1, respectively. (The value for scale constant Z should never be zero.)

e. FREQ A

f. Slope A (positive); Slope B (negative)

g. Attenuation: X1 (Input A); X50 (Input B)

h. Input impedance: 1 MΩ

i. Separate inputs (i.e., Common A LED is off)

j. Filter: off

k. Hysteresis: 25 mV p-p (lower value)

l. Sample(n) value: 100

m. Input A and B trigger levels: Zero (relevant only if auto-trigger is not selected)

n. Input Coupling: AC-coupled (Inputs A and B)

3.2.4 Main Display

3.2.4.1 Readings are displayed in engineering format with a 10-digit mantissa, 1-digit exponent, and floating decimal point. It is assumed that the reading is positive unless (1) the negative-sign LED to the left of the display is lit, or (2) a negative sign precedes the displayed mantissa. Keyboard entries are always right-justified. The largest displayed reading is 999.9999999 with a +9 exponent; the smallest number is 1.000000000 with a -9 exponent. The 1-digit exponent range is -9 to +9.

3.2.4.2 The selected function and gate time determine the number of digits displayed. Generally, the longer the gate time, the more digits displayed. The RESOLUTION (↑↓) keys are used to either step the gate time up (to 100 seconds), increasing the number of digits displayed; or down (to 200 nanoseconds), decreasing the number of digits displayed.

3.2.4.3 LED indicators for units in Hz (hertz) and S (seconds) are located at the right of the exponent display. Units for some functions are implied. For example, phase angle measurements are in degrees. Seven LEDs (O/F, REM, ADDR, SRQ, EXT ARM, EXT STD, and GATE) are situated immediately below the display (see Table 3.1).

3.2.5 Keyboard Organization

3.2.5.1 The front panel of the 1995/1996 is arranged logically by function into color-coded keyboard/LED groups. Refer to the front-panel figures and Table 3.1 for location and description. Listed below (left to right) are the keyboard groups with their color coding indicated in parentheses:

a. General Operating (gray)

b. FUNCTION (yellow)

c. INPUT C (1996 only-blue)

d. DATA ENTRY (brown)

e. INPUT A (blue)

f. Input Control (gray)

g. INPUT B (blue)

3.3 PANEL DESCRIPTIONS

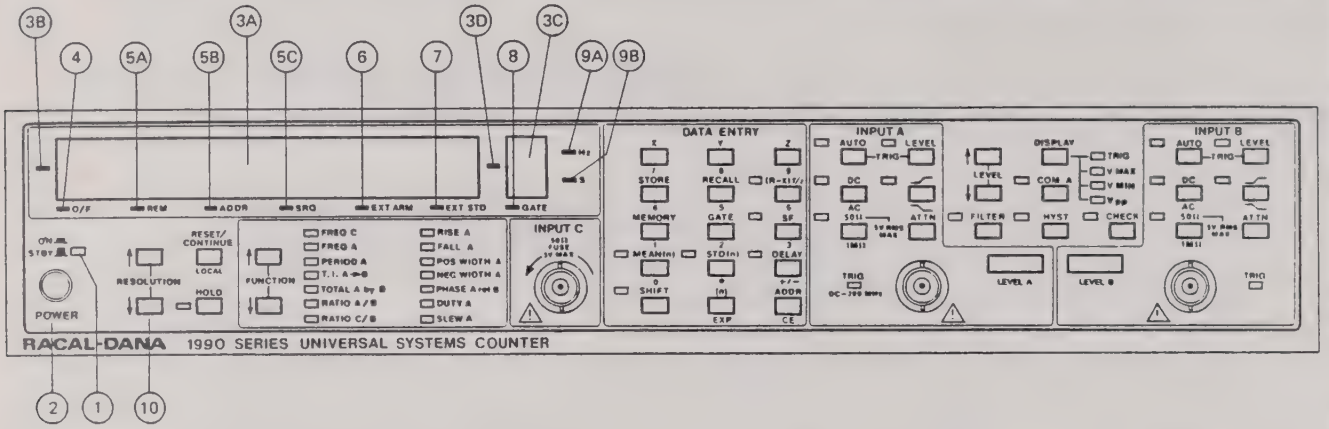
3.3.1 Front Panel Features

3.3.1.1 Refer to Table 3.1 and the front-panel figures. They show and describe front-panel controls, indicators, and connectors.

NOTE:

In the following table, LEDs shown in the "Item" column with an asterisk (*) are described in their lit condition. Certain LEDs are associated with toggle keys; their lit condition is specified.

Table 3.1 - Front-Panel Controls, Indicators, and Connectors

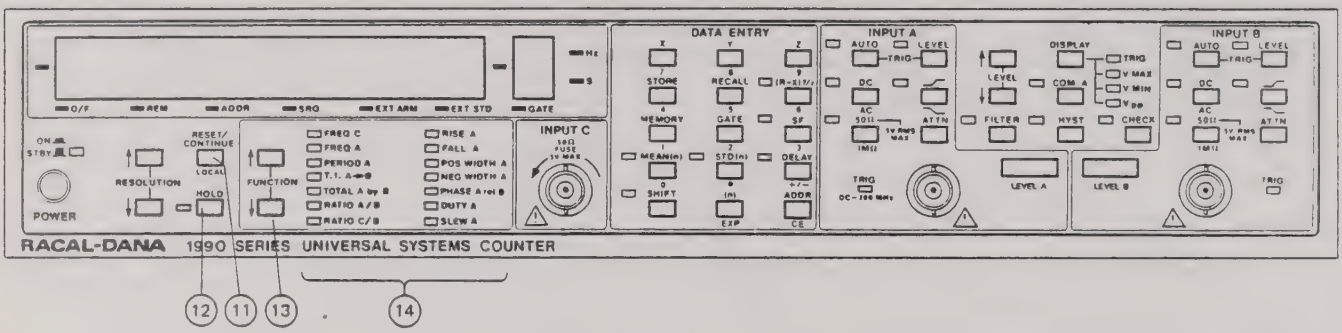


Reference	Item	Function/Description
(1)	STBY LED*	In Standby. Rear-panel POWER switch is on, front-panel POWER (ON/STBY) button is out, and power is supplied only to the internal reference standard (timebase)
(2)	POWER (ON/STBY) Button	In ON position, power is supplied to the entire counter and the STBY LED is off
(3)	Measurement Display:	A 7-segment LED digital display. Uses engineering format with 10-digit mantissa, 1-digit exponent, and floating decimal point. The display shows one of the following depending on operational state: _____ measurement results _____ numbers for data entry _____ numbers for recall from constant or function stores _____ error messages **NOTE:** The exponent LED is blanked and should be considered zero during the following: a. phase measurement b. totalize measurement with less than ten digits c. numeric entries not involving an exponent
(3A)	Mantissa Display LEDs*	Display right-justified mantissa
(3B)	Mantissa Sign LED*	Negative display number
(3C)	Exponent Display LED*	One-digit exponent number
(3D)	Exponent Sign LED*	Negative exponent

Table 3.1 - Front-Panel Controls, Indicators, and Connectors (Con't)

Reference	Item	Function/Description
(4)	O/F LED*	Readout overflows the tenth digit of the display
(5)	GPIB LEDs:	
(5A)	REM LED*	Counter under remote control over the GPIB interface
(5B)	ADDR LED*	Counter is being addressed as either a talker or listener over the GPIB interface
(5C)	SRQ LED*	Counter has transmitted a service request over the GPIB interface
(6)	EXT ARM LED*	External arming is controlling the measurement start and stop points
(7)	EXT STD LED*	Counter is operating from an external frequency standard reference
(8)	GATE LED*	Measurement gate is operating, starting or stopping a measurement cycle
(9)	Display Units LEDs:	NOTE: Neither LED lights when a phase angle, ratio, totalize measurement, or a constant is displayed
(9A)	Hz LED*	Units in Hertz for a frequency measurement
(9B)	S LED*	Units in Seconds for a time measurement
(10)	RESOLUTION Keys (▲▼)	Step the measurement period (i.e., gate time and also the resolution) either up (▲) or down (▼). This increases or decreases the number of digits displayed. In Recall Special Function mode, the **lowest** special function number is initially displayed. Use the RESOLUTION (▲▼) keys to scroll (with wrap-around) through special function numbers on display

Table 3.1 - Front-Panel Controls, Indicators, and Connectors (Con't)



Reference	Item	Function/Description
(11)	RESET/CONTINUE, LOCAL Key	This key provides the following: **RESET** Terminates the measurement in progress, clears the main display, and triggers a new measurement **NOTE:** In HOLD mode, pressing this key triggers a new measurement cycle **CONTINUE** Returns the counter to the measurement mode, triggers a new measurement cycle, after the display of recalled number or constant **LOCAL** Returns the counter to front-panel control from remote control on the GPIB, provided local lockout has not been set
(12)	HOLD Key/LED	Toggles counter in and out of HOLD (single-shot measurement). LED lights in HOLD. In HOLD, the measurement in progress is completed and displayed. See NOTE under Reference (11). Special Function 61 causes the HOLD key to successively start and stop measurements for manual Totalize
(13)	FUNCTION Keys (▲ ▼)	Select in succession the counter's measurement function. The corresponding FUNCTION LED is lit. Function selection "wraps around" at both ends

Table 3.1 - Front-Panel Controls, Indicators, and Connectors (Con't)

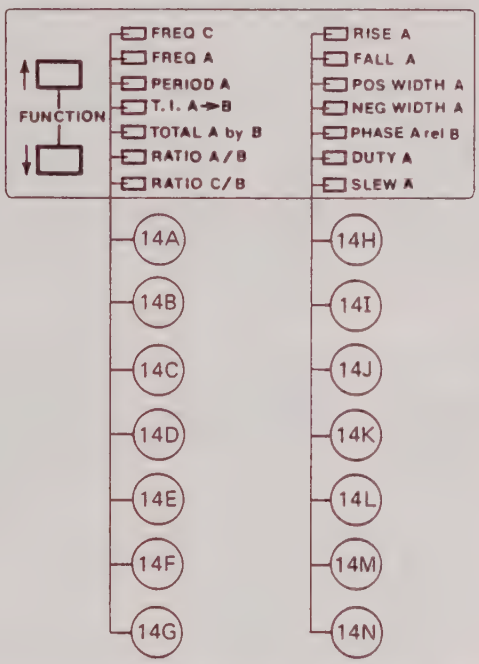
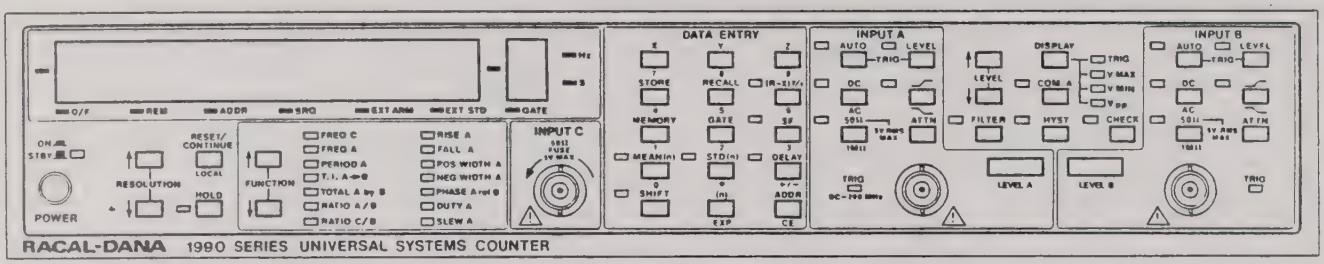
Reference	Item	Function/Description
(14)	FUNCTION LEDs:	Indicate selected function 
(14A)	FREQ C*	Input C Frequency (1996 only)
(14B)	FREQ A*	Input A Frequency
(14C)	PERIOD A*	Input A Period
(14D)	TI A→B*	Time Interval (Input A for start, Input B for stop)
(14E)	TOTAL A by B*	Totalize (Input A events gated by Input B)
(14F)	RATIO A/B*	Ratio A/B (Ratio of Frequency A to Frequency B)
(14G)	RATIO C/B*	Ratio C/B (Ratio of Frequency C to Frequency B)
(14H)	RISE A*	Input A Rise Time (10% start, 90% stop trigger points)
(14I)	FALL A*	Input A Fall Time (90% start, 10% stop trigger points)
(14J)	POS WIDTH A*	Input A Positive Pulse-Width (50% trigger points)
(14K)	NEG WIDTH A*	Input A Negative Pulse-Width (50% trigger points)
(14L)	PHASE A rel B*	Phase difference (Input A relative to Input B)
(14M)	DUTY A*	Input A Duty Cycle
(14N)	SLEW A*	Input A Slew Rate (positive/negative, 20% to 80% trigger points)

Table 3.1 - Front-Panel Controls, Indicators, and Connectors (Con't)



(15)

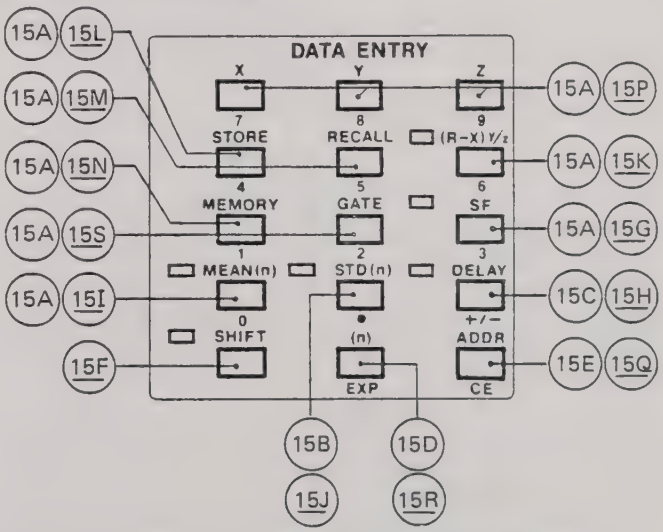
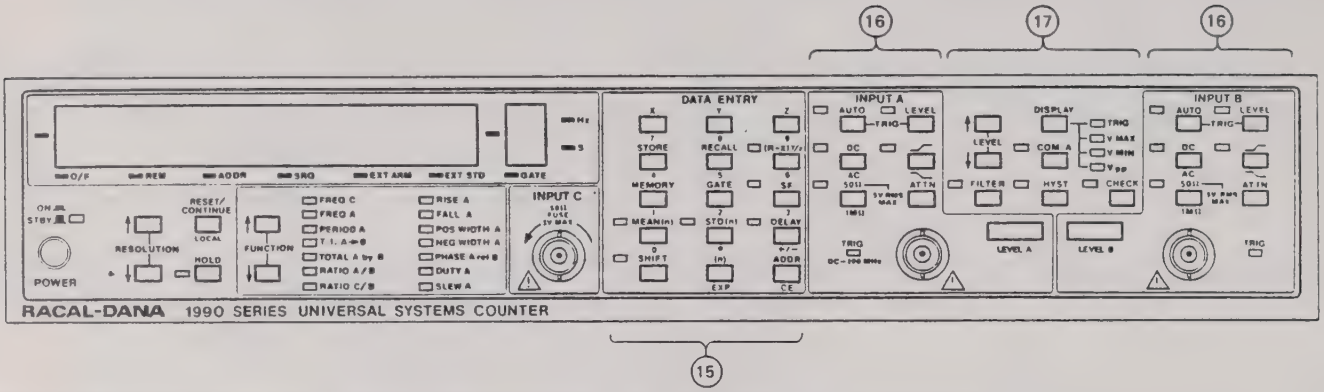
Reference	Item	Function/Description
(15)	DATA ENTRY Keys/LEDs **NOTE:** Designators for shifted key functions are underlined. Also, designator "150" is not used	Permit data entry and user interface with the 1995/1996 other than input signal conditioning and measurement functions 
(15A)	Unshifted Key functions: Numeric Keys (0-9)	Entry of numbers and constants for math, special functions, time-interval stop delays, trigger levels, and gate times. Also, used to recall machine setups. When a numeric key is pressed, the measurement in progress is aborted and the display shows the entered number
(15B)	Decimal Point (.) Key	Inserts decimal point during numeric entry
(15C)	Positive/Negative (+/-) Sign Key	Toggles sign of entered number (mantissa and/or exponent) between positive (no sign displayed) and negative (sign displayed)
(15D)	EXP Key	Changes data entry mode so that the next number entered is the exponent

Table 3.1 - Front-Panel Controls, Indicators, and Connectors (Con't)

Reference	Item	Function/Description
(15E)	CE Key	Clears current display number and entry
(15F)	Shifted Key Functions: SHIFT Key/LED*	Enables any shifted key function. After pressing a shifted key function (except for STORE, RECALL, and MEMORY), counter immediately returns to its unshifted state with the SHIFT LED turning off
(15G)	SF Key/LED*	Enables all selected special functions (SHIFT SF). Also stores (<NN> SHIFT STORE SF) and recalls (SHIFT RECALL SF) special functions. See Subsection 3.4.8 for details
(15H)	DELAY Key/LED*	Enables a time-interval stop delay (SHIFT DELAY) in TI A→B. Also, stores (<value> SHIFT STORE DELAY) and recalls (SHIFT RECALL DELAY) a time-interval stop delay. Enabling a delay in a non- TI function produces an error message. Selecting a non-TI function when in delay disables DELAY and turns off the LED
(15I)	MEAN(n) Key/LED*	Enables calculation and display of the mean (average) of (n) samples. Pressing SHIFT MEAN(n) deselects the STD(n) key if enabled. Pressing RESET restarts the period of (n) samples
(15J)	STD (n) Key/LED*	Enables calculation and display of the standard deviation of (n) samples. Pressing SHIFT STD(n) deselects the MEAN(n) key if enabled. Pressing RESET restarts the period of (n) samples
(15K)	(R-X) Y/Z Math Key/LED*	Selection of Math computation mode
(15L)	STORE Key	Stores constants for math functions, gate time, time-interval delay, (n) samples, GPIB address and special functions. Used with MEMORY key to store complete measurement (i.e., machine) setups
(15M)	RECALL Key	Recalls constants for math functions, gate time, time-interval delay, (n) samples, GPIB address and special functions and calibration. Used with MEMORY key to recall complete measurement (i.e., machine) setups
(15N)	MEMORY Key	Store and recall complete measurement setups, memory locations 0 to 9, and calibration constants, locations 10 to 33 (see Table 3.16). Use the key sequence SHIFT STORE/RECALL MEMORY<N>. Attempted store or recall of an out-of-range number produces an error message

Table 3.1 - Front-Panel Controls, Indicators, and Connectors (Con't)



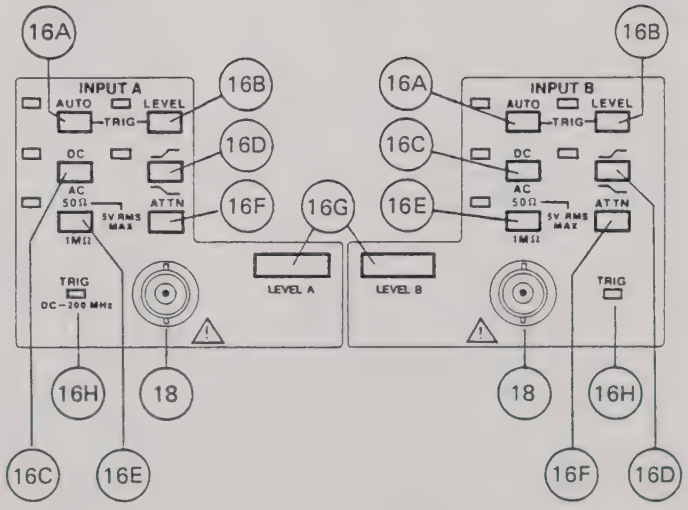
Reference	Item	Function/Description
15P	X/Y/Z Keys	Store and recall Math computation constants (X, Y and Z)
15Q	ADDR Key	Store and recall the counter's GPIB address. Address procedure is shown on rear panel (see Table 3.2) to the right of the GPIB connector
15R	(n) Key	Store and recall of (n) samples for statistics. Range of (n) is 2 to 9999
15S	GATE Key	Store and recall gate time
16	INPUT A and B Keys/ LEDs	
16A	AUTO-TRIG Keys/LEDs*	Automatic trigger setting and tracking for Inputs A and B
16B	TRIG-LEVEL Keys/LEDs*	Manual trigger setting for Inputs A and B
16C	DC/AC Keys/LEDs*	Toggle between DC/AC input coupling for Inputs A and B. LED lit when DC-coupled

Table 3.1 – Front-Panel Controls, Indicators, and Connectors (Con't)

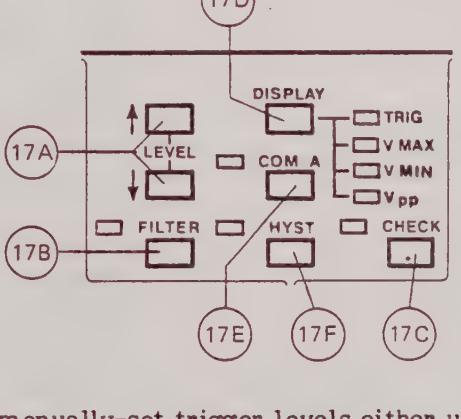
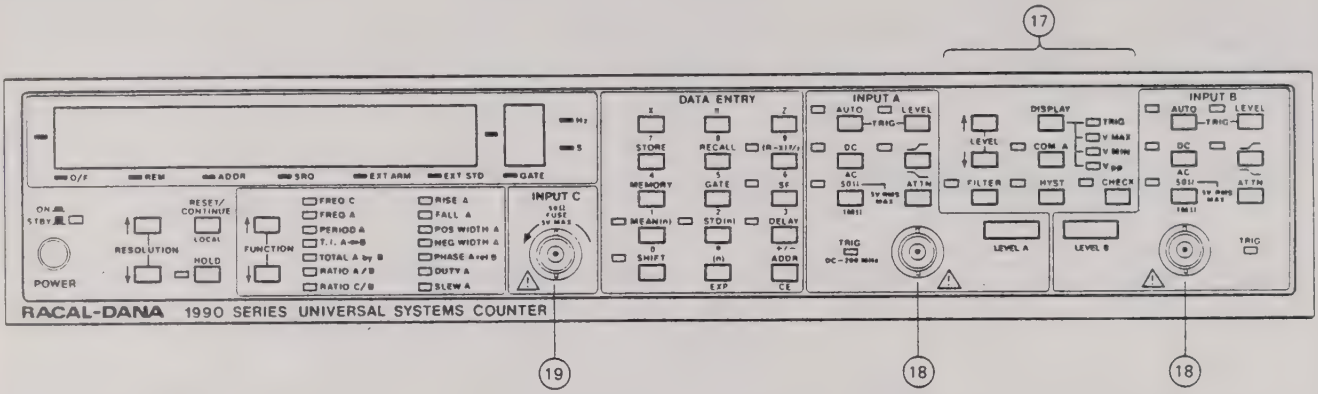
Reference	Item	Function/Description
(16D)	⎍/⎏Keys/LEDs*	Toggle between positive (⎍) and negative (⎏) trigger slopes of Inputs A and B. LED lit in positive slope
(16E)	50Ω/1MΩ Keys/LEDs*	Toggle between 50Ω and 1MΩ input impedance for Inputs A and B. LED lit in 50Ω mode
(16F)	ATTN (X1, X10, X50) Keys	Attenuation for Inputs A and B. The decimal point shifts in the LEVEL A and B displays, indicating attenuation range selected (X1=X.XX, X10=XX.X, and X50=XXX.)
(16G)	LEVEL A and B Displays	Indicate current trigger level (manual or auto-trigger). LEVEL A and LEVEL B also show TRIG (current trigger level), V MAX, V MIN, and Vpp when selected using the DISPLAY key (17D)
(16H)	TRIG LEDs/Inputs A and B	Flash to indicate input signal is triggering measurement circuits
(17)	INPUT CONTROL Keys/LEDs*	Control Input A and B signals NOTE: LEVEL ↑↓ keys have no LED indicators 
(17A)	LEVEL ↑ ↓ Keys	Step manually-set trigger levels either up (↑) or down (↓) in increments of 0.01, 0.1, or 1 volts for the X1, X10, and X50 attenuation ranges, respectively. Use key sequence TRIG-LEVEL LEVEL ↑↓ TRIG-LEVEL
(17B)	FILTER Key/LED	Toggles a low-pass input filter (100 kHz cutoff frequency) for Inputs A and B. LED lights when filter is on. Special Functions 28 and 29 permit separate filter selection for Inputs A and B, respectively

Table 3.1 - Front-Panel Controls, Indicators, and Connectors (Con't)



Reference	Item	Function/Description
(17C)	CHECK Key/LED	Verifies the proper operation of front-panel LEDs and executes internal self-tests. Pressing the CHECK key lights the CHECK LED immediately. However, the CHECK key must be held down about 3 seconds for all LEDs to light, all 8's to display, and the self-test functions to be executed. Release of the CHECK key extinguishes all LEDs and displays the word "TEST", indicating the unit is under self-test. When all self testing is completed the unit displays 5 MHz. Toggle the CHECK key to turn off the CHECK LED. Momentarily pressing the CHECK key will simply cause the counter to measure an internal 5 MHz test waveform
(17D)	DISPLAY Key/LEDs:	Scrolls through TRIG, V MAX, V MIN, and Vpp. Values are displayed in LEVEL A and LEVEL B
	TRIG *	Current trigger level
	V MAX *	Maximum peak voltage
	V MIN *	Minimum peak voltage
	Vpp *	Voltage peak-to-peak
(17E)	COM A Key/ LED	Toggles Input A also to B. LED lit in COM A mode
(17F)	HYST Key/LED	Toggles the hysteresis level for Inputs A and B between a low (25 mVpp) and high (100 mVpp) setting. HYST LED lights in the higher setting
(18)	INPUT(s) A and B	BNC connectors for INPUT(s) A and B. INPUT A is used for all functions except Frequency C (1996 only). INPUT B is used with INPUT A for Time Interval, Ratio A/B, Totalize, and Phase measurements. INPUT B is used with INPUT C for Ratio C/B. Special Function 21 internally exchanges INPUTS A and B (providing, e.g., FREQ B, etc. measurement capability)

Table 3.1 - Front-Panel Controls, Indicators, and Connectors (Con't)

Reference	Item	Function/Description
(19)	INPUT C (1996 only)	BNC connector high-frequency INPUT C (40 MHz-1.3 GHz range). INPUT C is used with INPUT B for Ratio C/B. Special Function 21 provides Ratio C/A capability. Protection against excessive signal levels (>5V rms) is provided by a fuse in the input socket

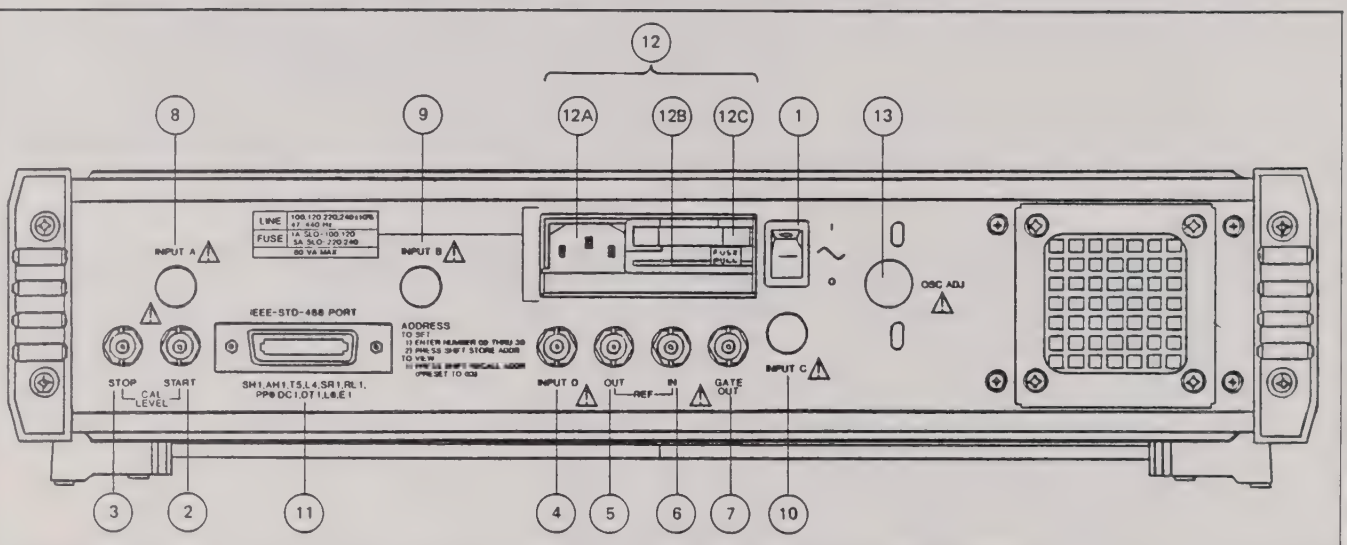
NOTE:

In the above table, LEDs shown in the "Item" column with an asterisk (*) are described in their lit condition. Certain LEDs are associated with toggle keys; their lit condition is specified.

3.3.2 Rear Panel Features

3.3.2.1 Refer to Table 3.2 and figure at top. They indicate and briefly describe the rear-panel controls and connectors.

Table 3.2 - Rear-Panel Controls and Connectors



Reference	Item	Function/Description
(1)	Main Power Switch	Enables Standby if the front panel POWER (ON/STBY) button is out (▲). This supplies power to the internal frequency standard (timebase). Also, switches counter ON/OFF if front-panel POWER (ON/STBY) button is in (▬)
	NOTE: Connectors (2) through (10) are BNCs	
(2)	START-CAL LEVEL Connector	Output: analog signal equivalent of the Start trigger level (for calibration only)
(3)	STOP-CAL LEVEL Connector	Output: analog signal equivalent of the Stop trigger level (for calibration only)
(4)	INPUT D Connector	Input: external arming/gating control signal
(5)	REF-OUT Connector	Output: 10 MHz internal reference
(6)	REF-IN Connector	Input: external reference frequency (1,5, or 10 MHz at 1V rms)
(7)	GATE OUT Connector	Output: negative-going TTL-compatible signal equivalent to the gate signal

Table 3.2 - Rear-Panel Controls and Connectors (Con't)

Reference	Item	Function/Description
(8)	INPUT A Connector (Option 01)	Rear-panel Input A
(9)	INPUT B Connector (Option 01)	Rear-panel Input B
(10)	INPUT C Connector (Option 01) **NOTE:** Front-panel INPUTS A, B, and C are not connected when Option 01 is installed. Input is only via the rear-panel connectors	Rear-panel Input C
(11)	GPIB Connector	GPIB (IEEE-STD-488-1978) connector
(12)	Power Input Module:	
(12A)	AC Power Input Socket	Standard connector for the AC power supply
(12B)	Line Voltage Selector	Small printed circuit card inserted in module to select correct AC line voltage. The selected voltage (100, 120, 220, or 240 VAC) is visible through the small window
(12C)	Line Fuse	A glass cartridge Slow-Blow fuse. Line fuse ratings for available line voltages are shown on the upper-left of the rear-panel
(13)	OSC ADJ	Adjustment of the internal reference frequency standard

3.4 OPERATING PROCEDURES

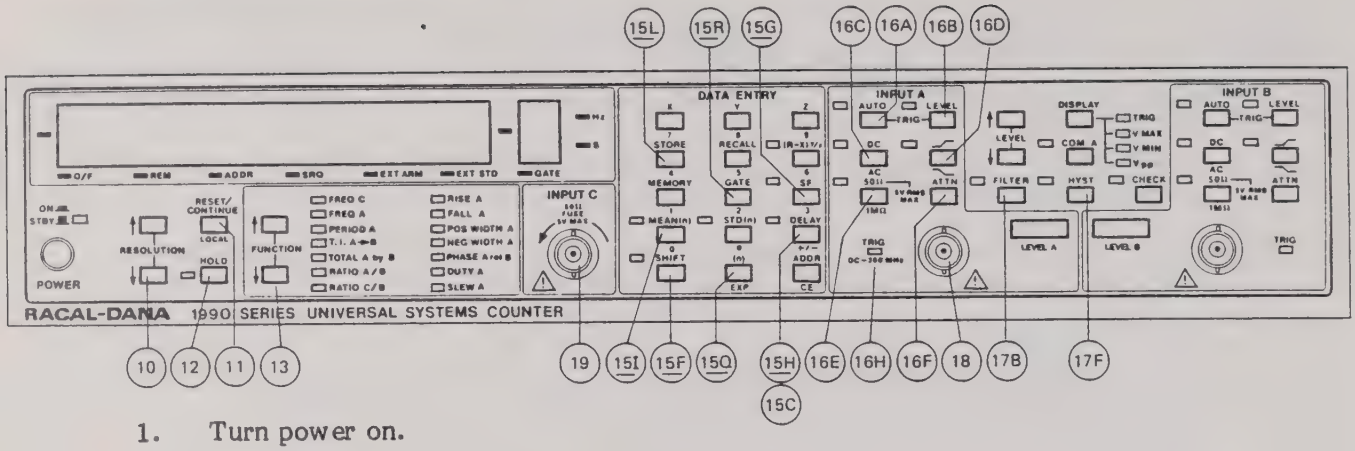
3.4.1 Measurement Functions

3.4.1.1 Tables 3.3-3.13 with figures describe the basic bench functions of the 1995/1996.

NOTE:

Review as required Table 3.1, References 18 and 19, for use of Inputs A, B, and C, including Special Function 21 permitting interchange of Inputs A and B. See also Subsection 3.4.8 and Table 3.14 for special functions.

Table 3.3 - Frequency Measurement



1. Turn power on.

2. Select FREQ A or FREQ C (1996 only) using FUNCTION keys (13).

3. If FREQ A is selected, set the AC/DC coupling (16C) and input impedance (16E) as required.

4. Select the X10 or X50 input attenuation (16F) if desired. Attenuation setting is automatic in the Auto-Trigger mode.

5. Connect the measurement signal to INPUT A (DC to 200 MHz) (18) or INPUT C (40 MHz to 1.3 GHz) (19).

6. If a specific gate time is desired, enter it (in seconds, using the exponential format for small values) using key sequence <value> SHIFT (15F) STORE (15L) GATE (15R). Skip step 7 if step 6 is being used to enter the gate time.

7. Use the RESOLUTION ↑↓ keys (10) to select the required display resolution and gate time if step 6 was not used.

8. If FREQ A is selected, either set the trigger level manually using key sequence <value> +/- (15C) TRIG-LEVEL (A) (16B), or select AUTO-TRIG (A) (16A). Check that Input A TRIG LED (16H) flashes.

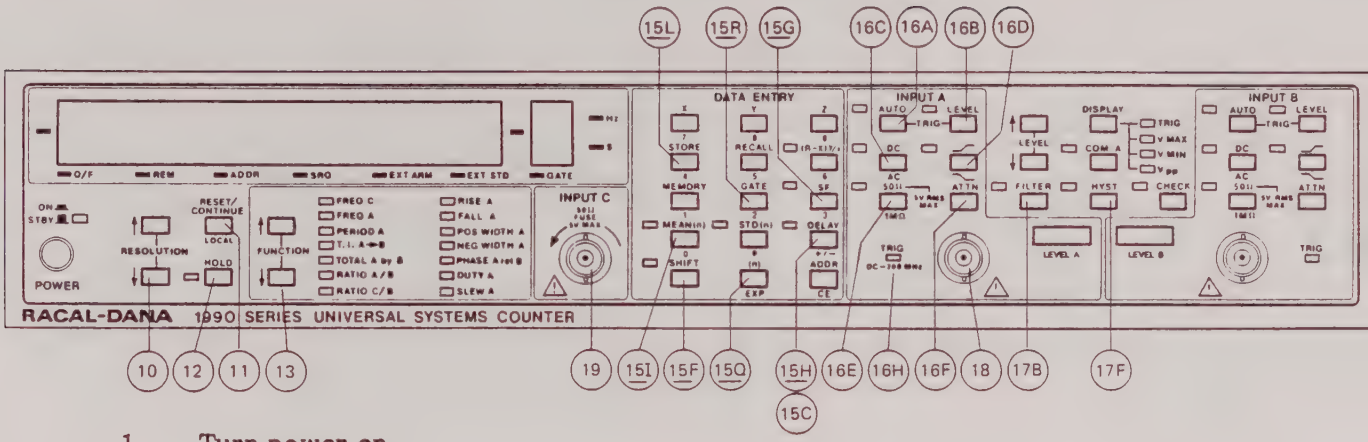
9. If a frequency below 100 kHz is to be measured in the presence of high frequency noise, select the FILTER (17B).

10. Set the input hysteresis (17F) at low or high as required. The high setting may be used to filter low-frequency noise.

11. If external arming/gating is needed, connect the arming/gating signal and select the special function number. Enable special functions. Refer to Subsection 3.4.8 for special function numbers and procedures.

12. Select the Hold mode (12) for single-shot measurements. Press the RESET (11) while in Hold to trigger a new measurement.

Table 3.4 - Period Measurement



1. Turn power on.

2. Select PERIOD A using FUNCTION keys (13).

3. Set the AC/DC coupling (16C) and input impedance (16E), as required.

4. Select the X10 or X50 input attenuation (16F) if desired. Attenuation setting is automatic in the Auto-Trigger mode.

5. Connect the measurement signal to INPUT A (18).

6. If a specific gate time is desired, enter it (in seconds using the exponential format for small values) using key sequence <value> SHIFT (15F) STORE (15L) GATE (15R). Skip step 7 if step 6 is being used to enter the gate time.

7. Use the RESOLUTION ↑↓ keys (10) to select the required display resolution and gate time if step 6 was not used.

8. Either set the trigger level manually using key sequence <value> +/- (15C) TRIG-LEVEL (A) (16B), or select AUTO-TRIG (A) (16A). Check that Input A TRIG LED (16H) flashes.

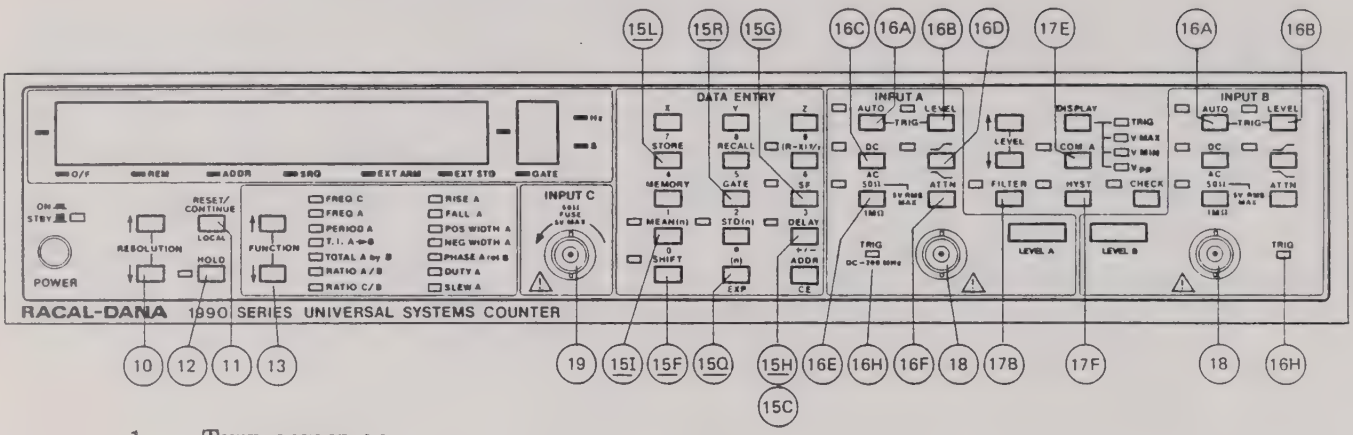
9. If a frequency below 100 kHz is to be measured in the presence of high frequency noise, select the FILTER (17B).

10. Set the input hysteresis (17F) at low or high as required. The high setting may be used to filter low-frequency noise.

11. If external arming/gating is needed, connect the arming/gating signal and store the special function number. Enable special functions. Refer to Subsection 3.4.8 for special function numbers and procedures.

12. Select the Hold mode (12) for single-shot measurements. Press the RESET (11) while in Hold to trigger a new measurement.

Table 3.5 - Time Interval Measurement



1. Turn power on.

2. Select TI A→B using FUNCTION keys (13).

3. Set AC/DC coupling (16C), input impedance (16E), and slope (16D) for Inputs A/B as required. If the start and stop signals are from the **same source**, select COM A (17E).

4. Select the X10 or X50 input attenuation (16F) if desired. Attenuation setting is automatic in the Auto-Trigger mode.

5. Connect the start signal to INPUT A (18). If a separate source for the stop signal is used, connect the stop signal to INPUT B (18).

6. Either set the trigger levels A/B manually using key sequence <value>+/- (15C) TRIG-LEVEL (16B), or select AUTO-TRIG A/B (16A). Check that Inputs A and B TRIG LEDs (16H) flash.

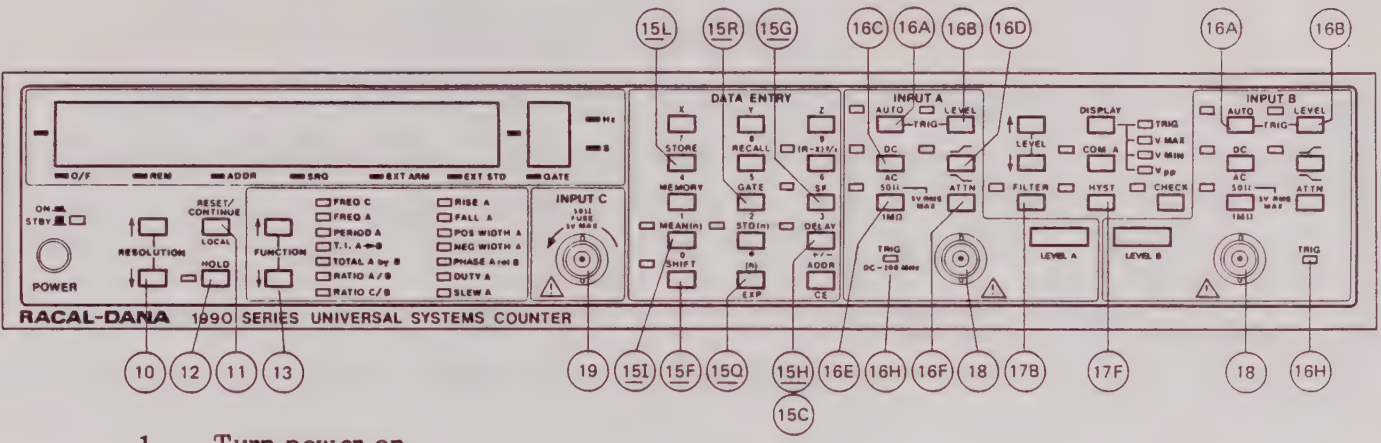
7. Set the input hysteresis (17F) at low or high as required.

8. If internal delayed arming of the stop circuit is required, enter the delay into memory using key sequence <value> SHIFT (15F) STORE (15L) DELAY (15H). Enable the delay using key sequence SHIFT (15F) DELAY (15H).

9. If external arming/gating is needed, connect the arming/gating signal and store the special function number. Enable special functions. Refer to Subsection 3.4.8 for special function numbers and procedures.

10. Select the Hold mode (12) for single-shot measurements. Press the RESET (11) while in Hold to trigger a new measurement.

Table 3.6 - Total A by B Measurement



1. Turn power on.

2. Select TOTAL A by B using FUNCTION keys (13).

3. Set AC/DC coupling (16C), input impedance (16E), and slopes (16D) as required.

4. Select the X10 or X50 input attenuation (16F) if desired. Attenuation setting is automatic in the Auto-Trigger mode.

NOTE:

Input A slope selects the slope of the events to be totalized. The measurement period, however, starts on Input B slope and stops on the opposite slope.

5. Connect the signal to be totalized to INPUT A (18) and the control signal to INPUT B (18).

6. Either set the trigger levels A/B manually using key sequence <value>+/- (15C) TRIG-LEVEL (16B), or select AUTO-TRIG A/B (16A). Check that Inputs A and B TRIG LEDs (16H) flash.

7. If a frequency below 100 kHz is to be measured in the presence of high-frequency noise, select the filter (17B).

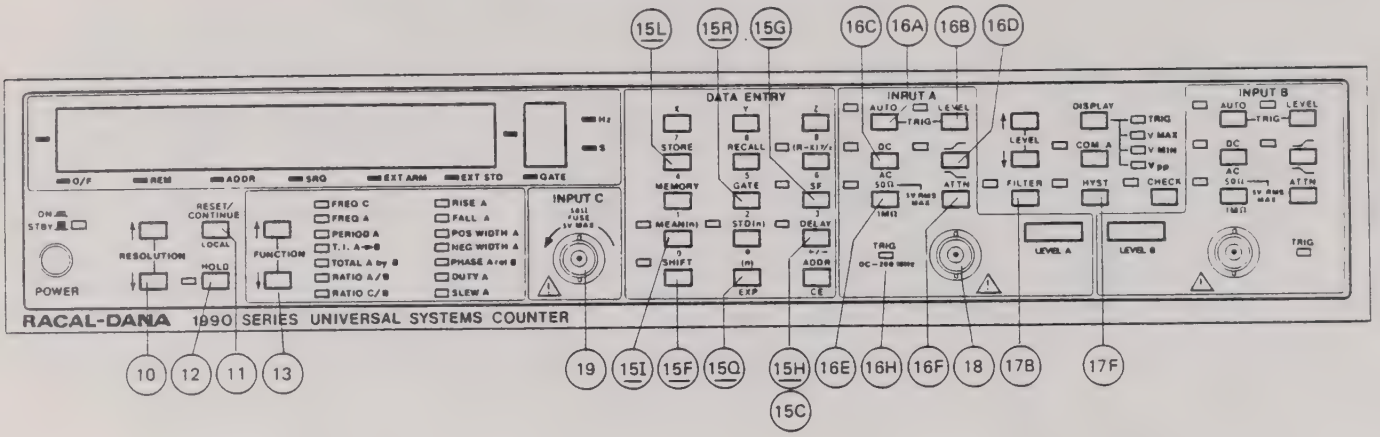
8. Set the input hysteresis (17F) at low or high as required. The high setting may be used to filter low-frequency noise.

9. If internal delayed arming of the stop circuit is required, enter the delay into memory using key sequence <value>SHIFT (15F) STORE (15L) DELAY (15H). Enable the delay using key sequence SHIFT (15F) DELAY (15H).

10. If external arming/gating is needed, connect the arming/gating signal and store the special function number. Enable special functions. Refer to Subsection 3.4.8 for special function numbers and procedures.

11. Select the Hold mode (12) if necessary. Press the RESET (11) while in Hold to trigger a new measurement.

Table 3.7 - Manual Totalize Measurement



1. Turn power on. Select TOTAL A by B using the FUNCTION keys (13).

2. Set AC/DC coupling (16C), input impedance (16E), and slope (16D) for Input A as required.

3. Select the X10 or X50 input attenuation (16F) if desired. Attenuation setting is automatic in the Auto-Trigger mode.

4. Enter Special Function 61 using key sequence 61 SHIFT (15F) STORE (15L) and SF (15G). Enable special functions using key sequence SHIFT (15F) SF (15G).

5. Connect the measurement signal to INPUT A (18).

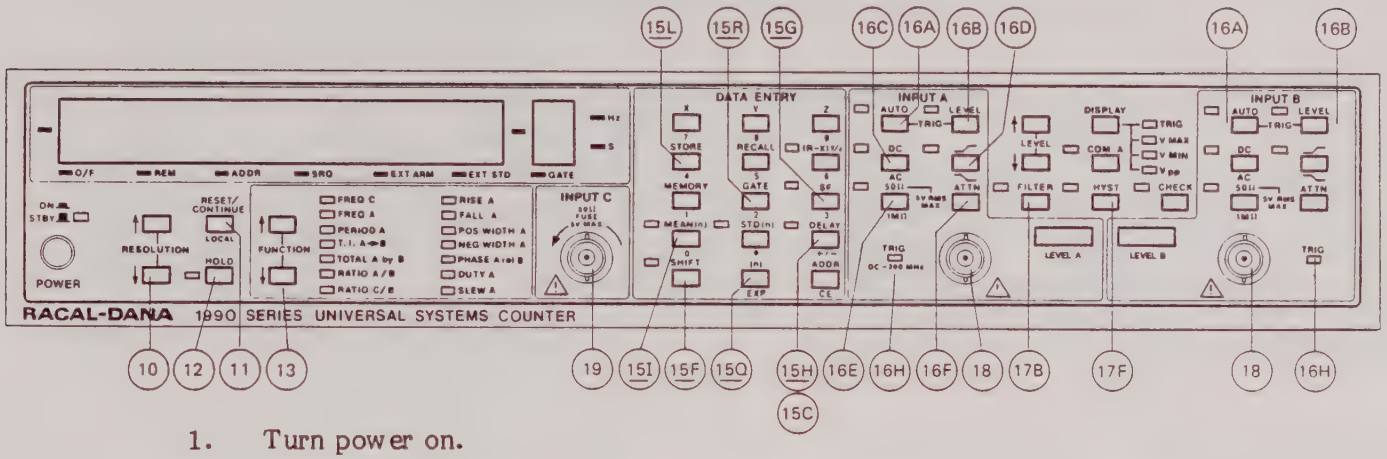
6. Either set trigger level A manually using key sequence <value> +/- (15C) TRIG-LEVEL (16B), or select AUTO-TRIG A (16A). Check that Input A TRIG LED (16H) flashes.

7. If a frequency below 100 kHz is to be measured in the presence of high-frequency noise, select the filter (17B).

8. Set the input hysteresis (17F) at low or high as required. The high setting may be used to filter low-frequency noise.

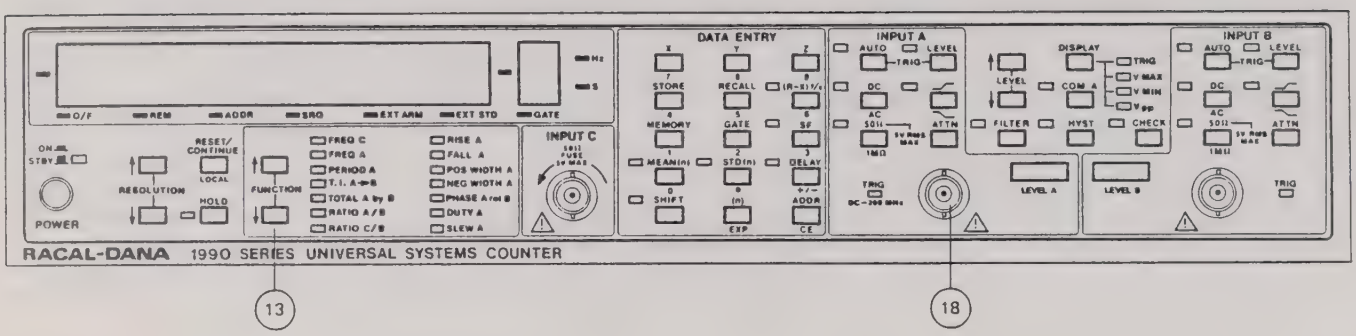
9. Operate the HOLD key (12). Verify that the count stops. The displayed result is cumulative over successive measurement cycles. Use the RESET key (11) to clear the display. Check that the main display blanks before triggering new measurement cycles.

Table 3.8 - Ratio A/B and C/B Measurements



1. Turn power on.
2. Select RATIO A/B or RATIO C/B (1996 only) using FUNCTION keys (13).
3. Set AC/DC coupling (16C), input impedance (16E), and slope(s) (16D) as required.
4. Select the X10 or X50 input attenuation (16F) if desired. Attenuation setting is automatic in the Auto-Trigger mode.
5. Connect one signal to INPUT B (18) and the other to INPUT A (18) or INPUT C (19). The lower frequency signal should be connected to INPUT B.
6. If a specific gate time is desired, enter it (in seconds, using the exponential format for small values) using key sequence <value> SHIFT (15F) STORE (15L) GATE (15R). Skip step 7 if step 6 is being used to enter the gate time.
7. Use the RESOLUTION ↑↓keys (10) to select the required display resolution.
8. If RATIO A/B is selected, either set trigger levels A/B manually using key sequence <value> +/- (15C) TRIG-LEVEL (16B), or select AUTO-TRIG A and B (16A). Check that Inputs A and B TRIG LEDs (16H) flash. For RATIO C/B, a trigger level for only INPUT B may be specified.
9. If a frequency below 100 kHz is to be measured in the presence of high-frequency noise, select the filter (17B).
10. Set the input hysteresis (17F) at low or high as required.
11. If external arming/gating is needed, connect the arming/gating signal and select the special function number. Enable special functions. Refer to Subsection 3.4.8 for special function numbers and procedures.
12. Select the Hold mode (12) for single-shot measurements. Press the RESET (11) while in Hold to trigger a new measurement.

Table 3.9 - Positive/Negative Pulse Width Measurements

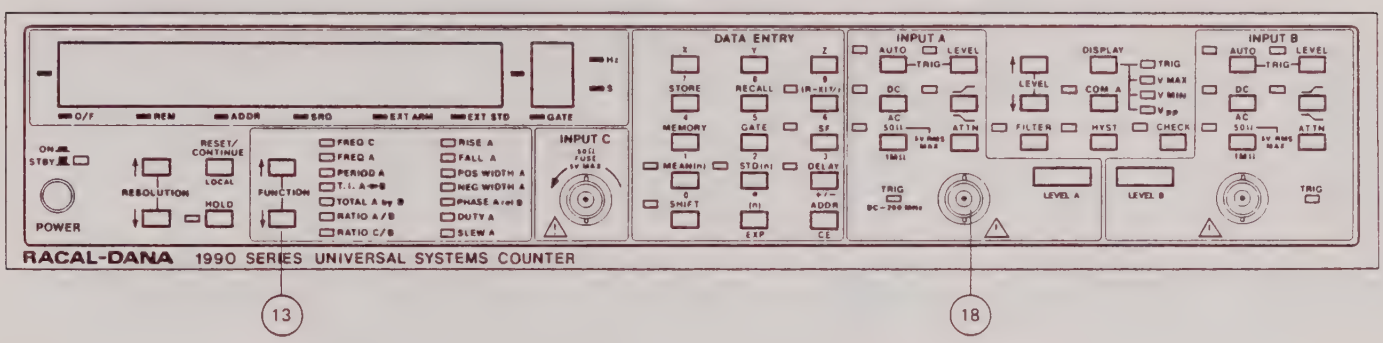


1. Turn power on.
2. Select either POS WIDTH A or NEG WIDTH A using FUNCTION keys (13).
3. Connect measurement signal to INPUT A (18).

NOTE:

All other controls are set automatically.

Table 3.10 - Rise A/Fall A Measurements

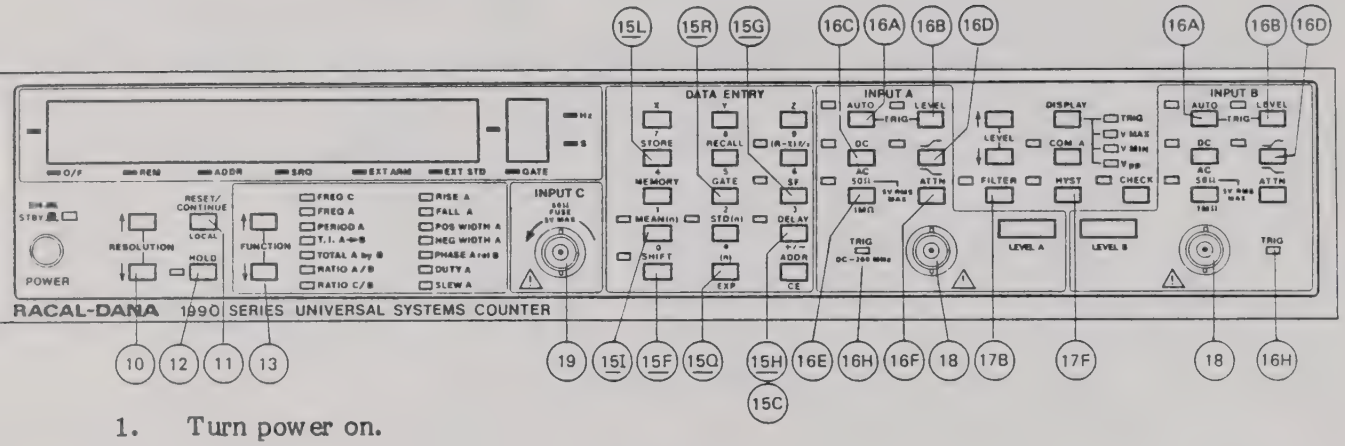


1. Turn power on.
2. Select either RISE A or FALL A using FUNCTION keys (13).
3. Connect measurement signal to INPUT A (18).

NOTE:

All other controls are set automatically.

Table 3.11 - Phase A rel B Measurement



1. Turn power on.

2. Select PHASE A rel B using FUNCTION keys (13).

3. Select AC/DC coupling (16C), input impedance (16E), and slopes (16D) as required. Selected slopes for signals A and B should be the same.

4. Select the X10 or X50 input attenuation (16F) if desired. Attenuation setting is automatic in the Auto-Trigger mode.

5. Connect the signals to be compared to INPUT A and INPUT B (18).

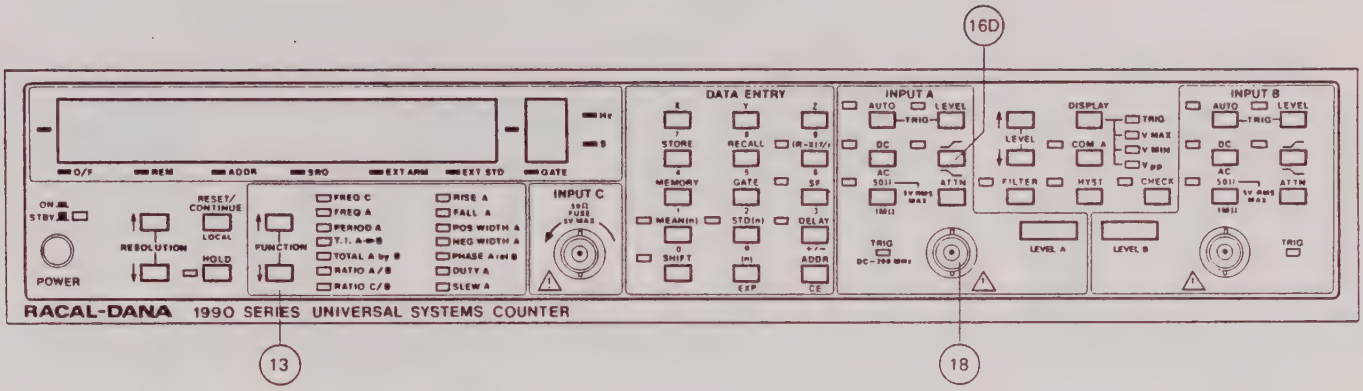
6. Either set the trigger levels A/B manually using key sequence <value> +/- (15C) TRIG-LEVEL (16B), or select AUTO-TRIG A/B levels (16A). Check that Inputs A/B TRIG LEDs (16H) flash.

7. Select the Hold mode (12) for single-shot measurements. Press the RESET (11) while in Hold to trigger a new measurement.

NOTE:

A phase measurement is always positive, representing the angle by which Input A's signal leads that of Input B. The signals for phase measurement must be continuous and have the same frequency.

Table 3.12 - Duty A Measurement

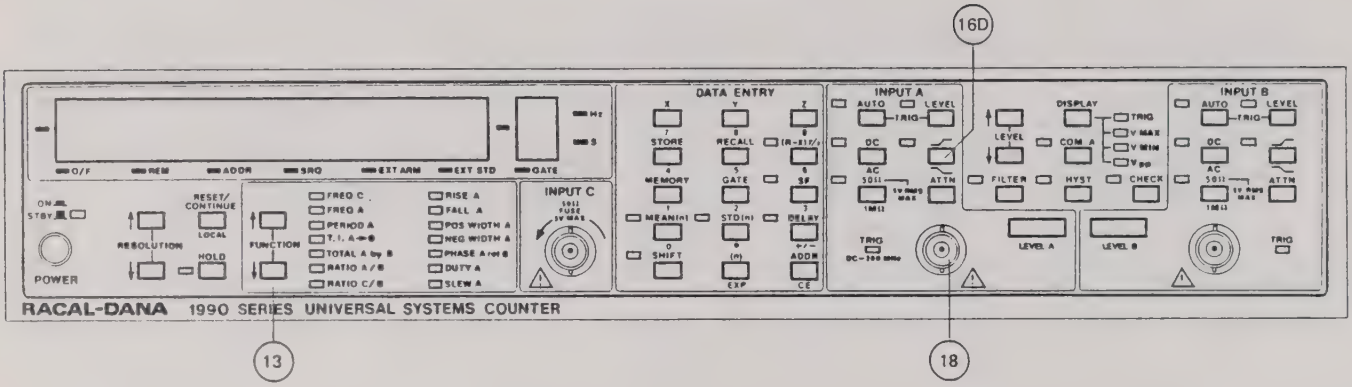


1. Turn power on.
2. Select DUTY A using FUNCTION keys (13).
3. Select the slope (16D) as required.
4. Connect the signal to INPUT A (18).

NOTE:

All other controls are set automatically.

Table 3.13 – Slew A Measurement



1. Turn power on.
2. Select SLEW A using FUNCTION key (13).
3. Select the slope (16D) as required.
4. Connect the signal to INPUT A (18).

NOTE:

All other controls are set automatically.

3.4.2 Trigger Level Setting

3.4.2.1 Introduction

3.4.2.1.1 Refer to Figure 3.1 for this subsection. The 1995/1996 both provide manual and automatic (including single-shot) trigger setting for Inputs A and B. Manual trigger selection involves setting the levels in ±5V, ±50V, and ±250V ranges, with corresponding resolutions of 10 mV, 100 mV, and 1V. These ranges correspond to attenuation settings of 1X, 10X, and 50X and LEVEL A and B trigger displays of X.XX, XX.X, and XXX., respectively. Auto-Trigger level is the mean of the positive and negative-peak values of the input signal as automatically determined by the counter.

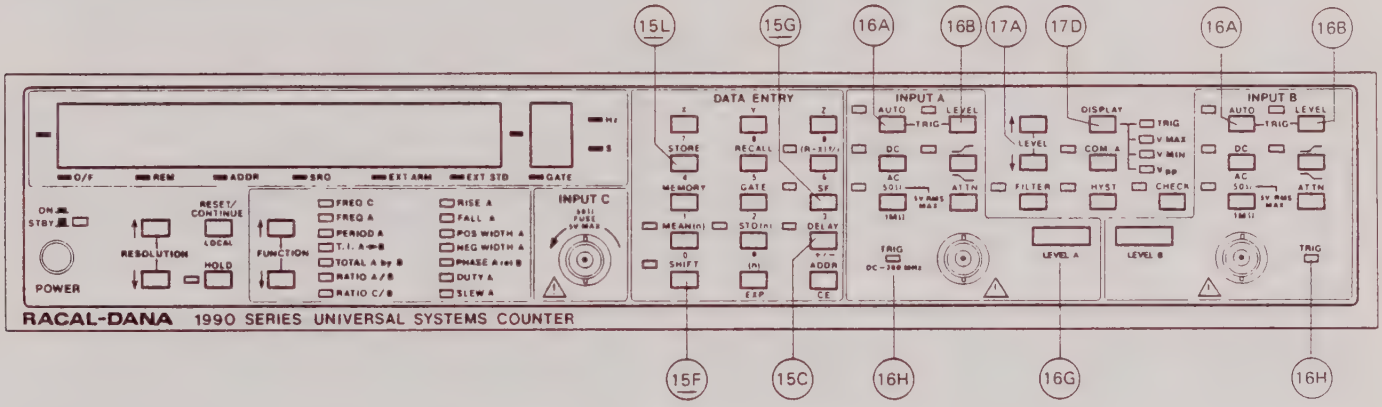


Figure 3.1 - Trigger Level Setting

3.4.2.2 Manual Trigger Setting

NOTE:

An attenuation setting of X1 and a trigger level of 1.23 volts are used in the following description.

3.4.2.2.1 Set the trigger level manually using one of the following key sequences:

a. For setting a +1.23, use <1.23> TRIG-LEVEL (16B)

b. For setting a -1.23, use +/- (15C) <1.23> TRIG-LEVEL (16B)

3.4.2.2.2 After entering a manual trigger level, it is continuously displayed on the LEVEL A/LEVEL B LED(s) (16G). The 1995/1996 returns immediately to its measurement mode after trigger setting. TRIG A/TRIG B LED(s) (16H) flash if the counter is triggered from the input signal.

3.4.2.2.3 Use key sequence TRIG-LEVEL (16B) LEVEL ↑↓ (17A) TRIG-LEVEL (16B) to step the displayed trigger level up or down by 0.01 (X1), 0.1 (X10), or 1. (X50) as required. Verify the trigger level changes on the LEVEL A/LEVEL B LED(s) (16G).

3.4.2.2.4 A manual trigger level that is out-of-range for the current attenuation setting produces an error message.

NOTE:

INPUT A and B each have one trigger-level store. Using the Auto-Trigger mode overwrites a manually stored trigger setting. Also, pressing the AUTO-TRIG key (16A) while manually setting the level enables the Auto-Trigger mode. Toggle the AUTO-TRIG key (16A) off, then enter a manual trigger level.

3.4.2.2.5 Press the DISPLAY key (17D) to show V MAX, V MIN or Vpp of the input signal in the LEVEL A/LEVEL B display.

3.4.2.3 Automatic Trigger Setting

3.4.2.3.1 Press the required AUTO-TRIG key (16A) to calculate and show the trigger level in the LEVEL A/LEVEL B display. Automatic attenuation setting occurs in the Auto-Trigger mode.

3.4.2.3.2 Press the DISPLAY key (17D) to show V MAX, V MIN, or Vpp of the input signal in the LEVEL A/LEVEL B display.

3.4.2.4 Single-Shot Automatic Trigger

3.4.2.4.1 Automatic trigger settings vary as peak input levels change. To execute and store a single-shot Auto-Trigger level:

a. Enter Special Function 31 using key sequence 31 SHIFT (15F) STORE (15L) and SF (15G)

b. Enable special functions using key sequence SHIFT (15F) SF (15G)

c. Press the AUTO-TRIG key (16A) . The LED lights as the level is calculated and set, then turns off.

3.4.2.4.2 The stored level is retained as a manually set value until either (1) another single-shot measurement is made, or (2) a new manual trigger level is entered.

3.4.2.4.3 To execute additional single-shot trigger settings, press the AUTO-TRIG key (16A) again with Special Function 31 enabled.

3.4.3 Gate Time and Resolution

3.4.3.1 Frequency Functions

3.4.3.1.1 Gate Time Mode - by specifying the counter's gate time, the user can set the resolution in the frequency, period, and ratio functions. Gate times from 200 ns to 100s may be selected. To enter a gate time, use the key sequence ⟨value⟩ SHIFT STORE GATE where ⟨value⟩ is either in decimal or exponential form. To recall a gate time for display, use the key sequence SHIFT RECALL GATE. Use the RESOLUTION ↑↓ keys to decadically step the displayed gate time (and resolution) either up(↑) towards 100 s or down (↓) towards 200 ns. The counter's gate time (and resolution) can be set to display from one to ten digits (with overflow).

EXAMPLE

Assume FREQ A is selected and a 1 ms gate time specified. Successively pressing the RESOLUTION (↑) key will select and display gate times (and resolutions) of 10 ms, 100 ms, 1s, 10s, and 100s. Successively pressing the RESOLUTION (↓) key will select and display gate times (and resolutions) of 100 µs, 10 µs, and 1 µs. Pressing the RESOLUTION (↓) key again after displaying 1 µs will not produce a gate time of 100 ns as this value is smaller than the 200 ns lower gate-time limit. The 1 µs will continue to display on the counter.

3.4.3.1.2 Resolution Mode - when no gate time is specified in frequency, period, and ratio functions, the counter's resolution can be selected using the RESOLUTION (↑↓) keys. Now the gate time is automatically set via the number of displayed digits of resolution. Except in some Math computations, pressing the RESOLUTION (↑ ↓) keys will increment/decrement the display by one digit per keyboard maneuver. Each digit displayed decadically increases/decreases the counter's resolution within the counter's gate time range. Gate times from 200 ns to 100 s may be selected. There will be no step-up or-down when the RESOLUTION (↑↓) keys are pressed in Time Interval, Totalize, Rise/Fall Time, Positive/Negative Pulse Width, or Slew Rate functions.

EXAMPLE

A 9-digit resolution of a measurement is possible in a 1-second gate time; 10-digit resolution in a 10-second gate time; and 10-digit resolution plus overflow in a 100-second gate time. If one selects a gate time which sets a resolution exceeding the 10-digit display resolution, then an overflow of the most significant digit(s) and lighting of the O/F LED occurs. Two overflow states are permitted in the 1995/1996. In an overflow condition, the user can reduce the gate time to display any "dropped" digit(s). Digits that overflow are not lost, but remain stored in the counter's registers for output over the GPIB.

3.4.3.2 Time Functions

3.4.3.2.1 In Time Interval functions (TI A→B, Rise/Fall, and Pulse Width, e.g.,), the input signal is synchronized with the measurement gate. Thus, there is no gate time as such. The input signal, therefore, determines the counter's resolution. On the 1995/1996, a single-shot Time Interval resolution to 1 ns is possible.

3.4.4 Delay Mode

3.4.4.1 When Time Interval (TI), Totalize, or Positive/Negative Pulse Width is selected, an internal delay from 200 ns to 100 s may be entered from the front panel. This permits the user to increase the elapsed time between the start and stop trigger points by the gate time range. Once stored, the delay may be enabled/disabled as required. Use of the Delay mode prevents premature triggering from spurious signals during measurement.

3.4.4.2 The delay is stored using either an exponential or decimal format. Use one of the following key sequences to store, for example, a 1 μs delay:

a. 1 EXPONENT +/- 6 SHIFT STORE DELAY

b. <.000001>SHIFT STORE DELAY

NOTE:

Once the delay is entered, the counter returns to the measurement mode.

3.4.4.3 Recall the delay to the main display using key sequence SHIFT RECALL DELAY.

3.4.4.4 Enable and disable a stored delay by successively using key sequence SHIFT DELAY. The LED lights when the Delay mode is enabled.

3.4.5 Arming/Gating Selection

3.4.5.1 Refer to Table 3.14 as required. External arming, external gating, and synchronous window auto-trigger (Syn. Wind. AT) modes are selectable via special functions for Inputs A, B, or D.

3.4.5.2 External Arming

3.4.5.2.1 Special Functions 82.0 through 83.3 as applied to the external arming input (A, B, or D) permit selection of positive or negative start edges in the 1995/1996.

3.4.5.3 External Gating

3.4.5.3.1 Special Functions 85.0 through 88.3 as applied to external gating inputs (A, B, or D) permit selection of positive or negative start/stop edges in the 1995/1996.

3.4.5.4 Synchronous Window Auto-Trigger (Syn. Wind. AT)

3.4.5.4.1 Special Functions 91.0 through 94.3 as applied to the external arming input (A, B, or D) permit selection of positive or negative start/stop edges in the counter. Auto-trigger can establish the positive/negative signal peak measurements and trigger level only during the time when the Syn. Wind. AT signal is present. The auto-trigger can now be used for display of peak voltage values of a specific pulse(s) selected by the operator using the Syn. Window AT signal.

3.4.6 Math Function (R-X)Y/Z

3.4.6.1 The Math function applies to all counting and timing functions of the 1995/1996 except phase measurement. This function permits measurement value R to be offset, normalized, and/or scaled before display using stored constants X, Y, and/or Z, respectively. The display indicates (R-X)Y/Z after enabling the Math function. Home state values for X, Y, and Z are 0, 1, and 1, respectively ($Z \neq 0$ at any time).

3.4.6.2 Math Constant Storage

3.4.6.2.1 Constants X, Y, and/or Z must be stored before enabling the Math function. Use key sequence <value> SHIFT STORE X/Y/Z, where <value> is in decimal or exponential form, to enter any of the constants. The permissible range of values for the Math constants is ± 0.000000001E-9 to ± 9999999999E9. Any number exceeding this range will result in "Error 20" being displayed.

3.4.6.3 Math Constant Recall

3.4.6.3.1 Recall stored Math constants to the main display using key sequence SHIFT RECALL X/Y/Z.

3.4.6.4 Math Function Enabling/Disabling

3.4.6.4.1 Enable and disable the Math function by successively using key sequence SHIFT (R-X)Y/Z. The LED lights when the Math function is enabled.

3.4.7 Statistical Functions/(n) Samples

3.4.7.1 The 1995/1996 Statistical functions include the Mean, Standard Deviation, and Low/High values for user-entered (n) samples. Mean and Standard Deviation are enabled using single front-panel keys; Low/High values by special functions.

3.4.7.2 (n) Samples

3.4.7.2.1 The range of (n) samples is any positive integer from 2 to 9999 (fractions entered for n are truncated). Home state value for (n) samples is 100.

3.4.7.2.2 To store (n) samples, use the key sequence <n> SHIFT STORE (n) where <n> is a valid integer. To recall (n) samples for display, use the key sequence SHIFT RECALL (n). Pushing RESET restarts the period of (n) samples.

3.4.7.3 High/Low Values

3.4.7.3.1 Use Special Function 51 and key sequences 51 SHIFT STORE SF and SHIFT SF to calculate and display the High value of (n) samples. Use Special Function 52 and key sequences 52 SHIFT STORE SF and SHIFT SF to calculate and display the Low value of (n) samples. If enabled, the MEAN(n) or STD(n) key is disabled during determination of High/Low values.

3.4.7.4 MEAN(n)/STD(n) Functions

3.4.7.4.1 Successively use key sequence SHIFT MEAN(n) or SHIFT STD(n) to enable and disable the corresponding statistical function. Pressing SHIFT MEAN(n)/SHIFT STD(n) automatically deselects the opposite function if enabled. Updating of the main display for either statistical function only occurs after (n) samples have been executed.

3.4.8 Special Functions

3.4.8.1 Table 3.14 lists the special functions available on the 1995/1996. All special functions are designated by either a two or three-digit special function number (NN or NN.N). In the table, special functions are organized by mutually exclusive groups shown by lined sections. Selecting a member of one of these groups automatically deselects all other special functions in that group. Storing a circled special function disables all special functions in a group. Circled special functions may not be recalled.

3.4.8.2 Special Function Storage

3.4.8.2.1 Special function numbers must be entered into memory before special functions can be enabled. Use the following key sequence to store, for example, special function number 81: 81 SHIFT STORE SF.

3.4.8.2.2 The digits for a special function number are shown on the main display as the numeric keys are pressed. Once the number is stored, the counter automatically returns to the measurement mode. Storing a special function number overwrites other numbers within its group.

3.4.8.3 Special Function Recall

3.4.8.3.1 Stored special functions are recalled to the main display using key sequence SHIFT RECALL SF. The lowest special function number in memory will be shown first on the display. Use the RESOLUTION keys (↑↓) to scroll through the current set of special function numbers.

3.4.8.4 Special Function Enabling/Disabling

3.4.8.4.1 Enable and disable stored special functions by successively using key sequence SHIFT SF. The LED lights when special functions are enabled.

NOTE:

Storing a special function when special functions are enabled immediately enables that special function.

Table 3.14 - Special Functions (SFs)

SF Number	Function
0	No special functions. Storing SF0 erases all current special functions. SF0 may be recalled for display. SF0 is present after power-up
(20)	Default for SF 21. Normal Inputs A and B
21	Inputs A and B exchanged
(27)	Default for SFs 28, 29. Filter functions for both Inputs A and B
28	Filter key functions with Input A only
29	Filter key functions with Input B only
(30)	Default for SF 31. Continuous Auto-Trigger mode
31	Single-Shot Auto-Trigger mode
(40)	Default for SF 41. Read rate of 300 ms
41	Maximum read rate
(50)	Default for SFS 51, 52. Normal statistics operation
51	Display highest value for (n) samples
52	Display lowest value for (n) samples
(60)	Default for SF 61. Automatic start/stop totalize
61	Manual start/stop totalize
70 - 79	Diagnostics/Calibration Routines. No SF enabling necessary; just store the SF to initiate the test
70	Keypad test for front-panel LEDs
(80)	Default for SFs 80 - 90. No external arming, external gate, or synchronous window auto-trigger (Syn. Wind. AT)

Table 3.14 - Special Functions (Cont'd)

SF Number	Function
(81)	External arming off
82.0	Ext. arming, (+) slope - Input A
82.1	- Input B
82.2	- Input D, Zero-Crossing Trigger Level
82.3	- Input D, TTL-Crossing Trigger Level
	(82.3 is the default for SFs 82.0 - 82.3)
83.0	Ext. arming, (-) slope - Input A
83.1	- Input B
83.2	- Input D, Zero-Crossing Trigger Level
83.3	- Input D, TTL-Crossing Trigger Level
	(83.3 is the default for SFs 83.0 - 83.3)
(84)	External gate off
85.0	Ext. gate, start (+) stop (+) - Input A
85.1	- Input B
85.2	- Input D, Zero-Crossing Trigger Levels
85.3	- Input D, TTL-Crossing Trigger Levels
	(85.3 is the default for SFs 85.0 - 85.3)
86.0	Ext. gate, start (+) stop (-) - Input A
86.1	- Input B
86.2	- Input D, Zero-Crossing Trigger Levels
86.3	- Input D, TTL-Crossing Trigger Levels
	(86.3 is the default for SFs 86.0 - 86.3)
87.0	Ext. gate, start (-) stop (+) - Input A
87.1	- Input B
87.2	- Input D, Zero-Crossing Trigger Levels
87.3	- Input D, TTL-Crossing Trigger Levels
	(87.3 is the default for SFs 87.0 - 87.3)
88.0	Ext. gate, start (-) stop (-) - Input A
88.1	- Input B
88.2	- Input D, Zero-Crossing Trigger Levels
88.3	- Input D, TTL-Crossing Trigger Levels
	(88.3 is the default for SFs 88.0 - 88.3)
(90)	Synchronous Window Auto-Trigger (Syn. Wind. AT) off
91.0	Syn. Wind. AT, start (+) stop (+) - Input A
91.1	- Input B
91.2	- Input D, Zero-Crossing Trigger Levels
91.3	- Input D, TTL-Crossing Trigger Levels
	(91.3 is the default for SFs 91.0 - 91.3)
92.0	Syn. Wind. AT, start (+) stop (-) - Input A
92.1	- Input B
92.2	- Input D, Zero-Crossing Trigger Levels
92.3	- Input D, TTL-Crossing Trigger Levels
	(92.3 is the default for SFs 92.0 - 92.3)

Table 3.14 - Special Functions (Cont'd)

SF Number	Function	
93.0	Syn. Wind. AT, start (-) stop (+)	- Input A
93.1		- Input B
93.2		- Input D, Zero-Crossing Trigger Levels
93.3		- Input D, TTL-Crossing Trigger Levels
	(93.3 is the default for SFs 93.0 - 93.3)	
94.0	Syn. Wind. AT, start (-) stop (-)	- Input A
94.1		- Input B
94.2		- Input D, Zero-Crossing Trigger Levels
94.3		- Input D, TTL-Crossing Trigger Levels
	(94.3 is the default for SFs 94.0 - 94.3)	

NOTE:

When the main function of the 1995/1996 is changed, Special Functions 80 - 94 are reviewed. If setup conditions are appropriate for the new function, they are retained; if they are not, they are cancelled. The setup conditions, however, are reactivated when the original function is reselected because of the counter's one level of keyboard memory.

.4.9 Error Codes

.4.9.1 Table 3.15 lists the error codes that may be displayed by the counter during local peration either as "OP Error" or in the form "Error NN" where NN is a 2-digit code number. Error codes will clear automatically after displaying for about 2-3 seconds.

Table 3.15 - Error Codes

Displayed Codes		Error
OP Error		Key invalid in present machine state or key out-of-sequence
Error	20	Input number out-of-range
	23	Phase measurement ratio out-of-range
	24	Hardware ratio measurement ratio produced divide by zero
	25	Internal totalize error
	34	Display underflow
	35	Display overflow
	40	Non-Vol Memory error during calibration
	41	Non-Vol Memory error-data verification failure of machine setup store
	42	Non-Vol Memory error-attempted recall of nonexistent machine setup store
	50	Normalize function error (R-X)Y/Z
	51	Statistical calculation error
	60	Internal self-test: RAM
	61	Internal self-test: ROM
	62	Internal self-test: Non-Vol Memory
	63	Internal self-test: measurement amplifier failure

Table 3.15 - Error Codes Cont'd)

Displayed Codes	Error
64	Internal self-test: measurement logic failure
70	Floating point addition error
71	Floating point multiplication error
72	Floating point division error
73	Floating point compare error
74	Floating point operation undefined
75	Floating point underflow
76	Floating point overflow
78	ASCII to floating point conversion error
79	Floating point to ASCII conversion error
80	Double precision compare error
81	Double precision to ASCII error
82	Double precision to floating point conversion error
83	Integer division by zero
99	Internal software error

Table 3.16 - Non-Vol Memory Locations

Function/Description	Location
Non-vol memory recall from 0-9	0-9
Non-vol memory store from 0-9	0-9 (see Notes)

NOTE 1:

Storing a setup (memory locations 0-9) requires a nominal 2-second wait after keyboard entry.

NOTE 2:

Calibration constants can only be viewed when the unit is in the Check mode. Also, calibration constants are only stored during the CAL Store step of the calibration procedure (see Section 5).

Recall calibration constants:	
DAC constants	
Input A slope multiplier	10
Input A slope offset	11
Input B slope multiplier	12
Input B slope offset	13
Input path constants	
Input A start, hyst. low, offset	14
Input A start, hyst. low, hysteresis	15
Input A start, hyst. high, offset	16
Input A start, hyst. high, hysteresis	17
Input A stop, hyst. low, offset	18
Input A stop, hyst. low, hysteresis	19
Input A stop, hyst. high, offset	20
Input A stop, hyst. high, hysteresis	21
Input B start, hyst. low, offset	22
Input B start, hyst. low, hysteresis	23
Input B start, hyst. high, offset	24
Input B start, hyst. high, hysteresis	25
Input B stop, hyst. low, offset	26
Input B stop, hyst. low, hysteresis	27
Input B stop, hyst. high, offset	28
Input B stop, hyst. high, hysteresis	29
Time Interval constants	
A-start, B-stop; A-positive, B-negative	30
A-start, A-stop; A-negative, B-positive	31
B-start, A-stop; A-positive, B-negative	32
B-start, B-stop; A-negative, B-positive	33

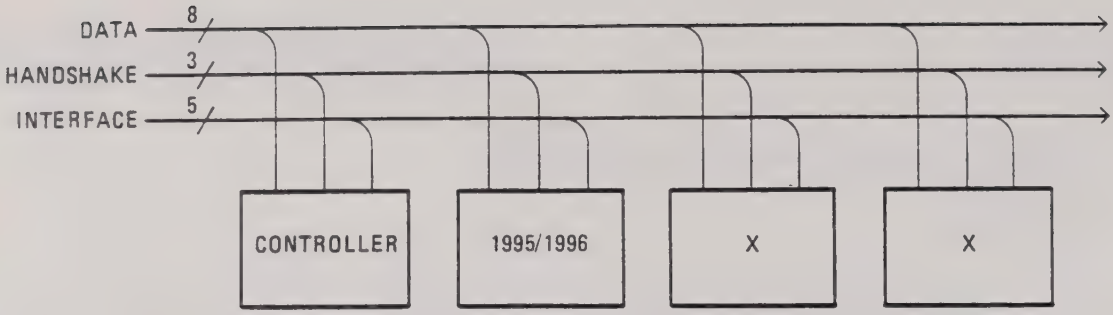
4.1 GENERAL PURPOSE INTERFACE BUS (GPIB)

4.1.1 Introduction

4.1.1.1 This subsection provides operating information for the 1995/1996 using the GPIB system interface. The IEEE-488-1978 interface permits remote control of all the counter's functions except POWER ON/OFF. Inputs and outputs are made via a standard 24-pin GPIB connector (see Figure 4.1) on the rear panel. Pin location, signal line identification, and GPIB operation comply with IEEE-STD-488-1978. The GPIB provides interface capability with other instruments and a controller also using the interface-bus structure (see Figure 4.2). This figure also shows signal line designations and pin assignments. IEEE-STD-488-1978 subsets available are listed in Table 4.1.

Pin No.	Assignment	Pin No.	Assignment
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI	17	REN
6	DAV	18	GND, (6)
7	NRFD	19	GND, (7)
8	NDAC	20	GND, (8)
9	IFC	21	GND, (9)
10	SRQ	22	GND, (10)
11	ATN	23	GND, (11)
12	SHIELD	24	GND, (5 and 17)

Figure 4.1 - GPIB Connector (Rear Panel)



Pin	Nomenclature	Description
1 2 3 4 13 14 15 16	DIO-1 Data In/Out Bit 1 (LSB) DIO-2 Data In/Out Bit 2 DIO-3 Data In/Out Bit 3 DIO-4 Data In/Out Bit 4 DIO-5 Data In/Out Bit 5 DIO-6 Data In/Out Bit 6 DIO-7 Data In/Out Bit 7 DIO-8 Data In/Out Bit 8	Data lines are used to transfer data from one instrument to another
6 7 8	DAV (Data Valid) NRFD (Not Ready for Data) NDAC (Not Data Accepted)	Handshake lines operate in a proper time sequence for complete communication between instruments
5 9 10 11 17	EOI (End or Identify) IFC (Interface Clear) SRQ (Service Request) ATN (Attention) REN (Remote Enable)	Interface lines are used to provide an orderly flow of information between units
12 18 19 20 21 22 23 24	SHIELD GND (6) GND (7) GND (8) GND (9) GND (10) GND (11) GND (5 and 17)	

Figure 4.2 - Interface Signal Pin Assignments

4.2 GPIB DESCRIPTION

4.2.1 Refer to Figure 4.2. There are 24 lines available at the GPIB connector, including 16 signal and 7 ground return lines, and one shield. All of the data bus lines are either input or output lines, having the following characteristics:

Logic Levels:	1 = Low = $\leq$.8V
	0 = High = $\geq$2.0V
Input Loading:	Each input = one TTL load
Output:	The output is capable of driving 15 interface bus loads. It consists of an open-collector driver and is capable of sinking 48 mA with a maximum voltage drop of 0.5 volts. See the IEEE-488 Electrical Specifications.

Table 4.1 - IEEE-488-1978 Standard Interface Subset Capability

GPIB Subset	Description	Applicable Capability
SH1	Source Handshake	Complete Capability
AH1	Acceptor Handshake	Complete Capability
T5	Talker	Complete Capability (1) Basic Talker (2) Serial Poll (3) Talk Only Mode (4) Unaddress if MLA
TE0	Extended Talker	None
L4	Listener	Complete except Listen Only (1) Basic Listener (2) Unaddress if MTA
LE0	Extended Listener	None
SR1	Service Request	Complete Capability
RL1	Remote/Local	Complete Capability (1) REN - Remote Enable (2) LLO - Local Lockout (3) GTL - Go to Local
PP0	Parallel Poll	No Capability
DC1	Device Clear	Complete Capability (1) DCL - Device Clear (2) SDC - Selected Device Clear
DT1	Device Trigger	Complete Capability GET - Group Execute Trigger
C0	Controller	No Capability
E1	Open Collector Bus Drivers	

4.2.2 The signal lines shown in Figure 4.2 consist of three functionally separate sets: Data, Handshake, and Interface.

4.2.2.1 **Data** - the data lines consist of DIO-1 to DIO-8. These lines are the signal channels over which data flows between all instruments on the bus in bit-parallel, byte-serial form.

4.2.2.2 **Handshake** - these three transfer lines consist of: DAV (Data Valid), NDAC (Not Data Accepted), and NRFD (Not Ready for Data). These lines provide communication between GPIB bus members (i.e., between the instrument that is talking and the instrument(s) that are listening) to synchronize the information flow across the eight data lines. These lines derive their nomenclature from their meaning in the low or 1 state (e.g., when NRFD is low, the device is Not Ready for Data).

a. **DAV** - signifies that valid information is available on the data lines

b. **NRFD** - signifies that the instrument is not ready to accept information

c. **NDAC** - signifies that information is not accepted by the acceptor bus device

4.2.2.3 **Interface** - these five interface lines coordinate the information flow on the bus.

a. **IFC (Interface Clear)** - places the instrument in the Idle state (i.e., Untalk, Unlisten)

b. **ATN (Attention)** - indicates the kind of information on the data lines during a handshake transfer sequence. Low indicates data lines carry interface commands; high indicates that the data lines carry data

c. **REN (Remote Enable)** - arms the instrument to select Remote operation when it's addressed as a listener

d. **SRQ (Service Request)** - signals the system controller that a peripheral device or bus member wants attention for purposes such as transmitting measurement, status, or condition information to the system controller

e. **EOI (End or Identify)** - used for (1) signifying the end of a message and (2) signalling bus peripherals to set the I/O bit assigned for parallel poll identification

4.2.3 GPIB Handshake

4.2.3.1 The handshake sequence is the process by which each data byte is transferred from the source to the acceptor.

4.2.3.2 Refer to Figure 4.3. It shows the sequential relationship between the DAV, NFRD, and NDAC lines used to transfer data bytes. Figure 4.4 shows the handshake flow chart.

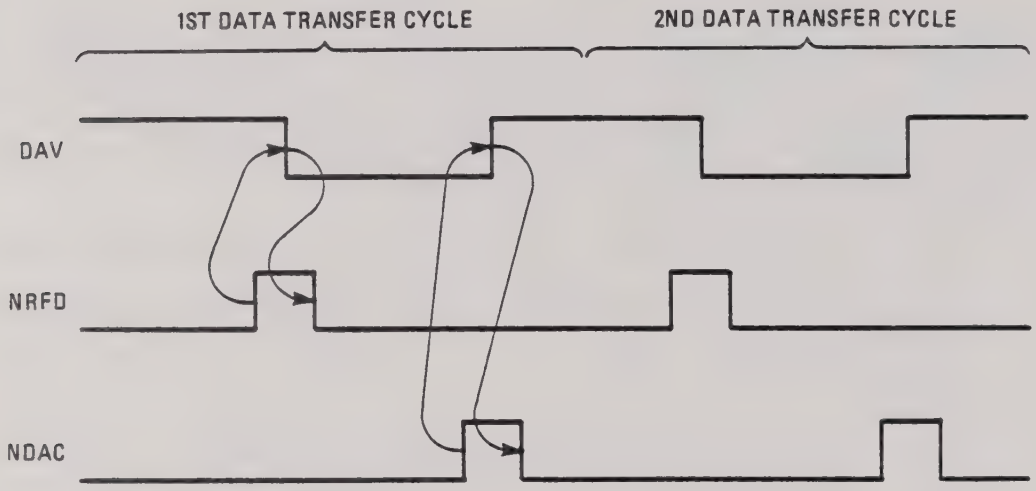


Figure 4.3 - Handshake Sequence

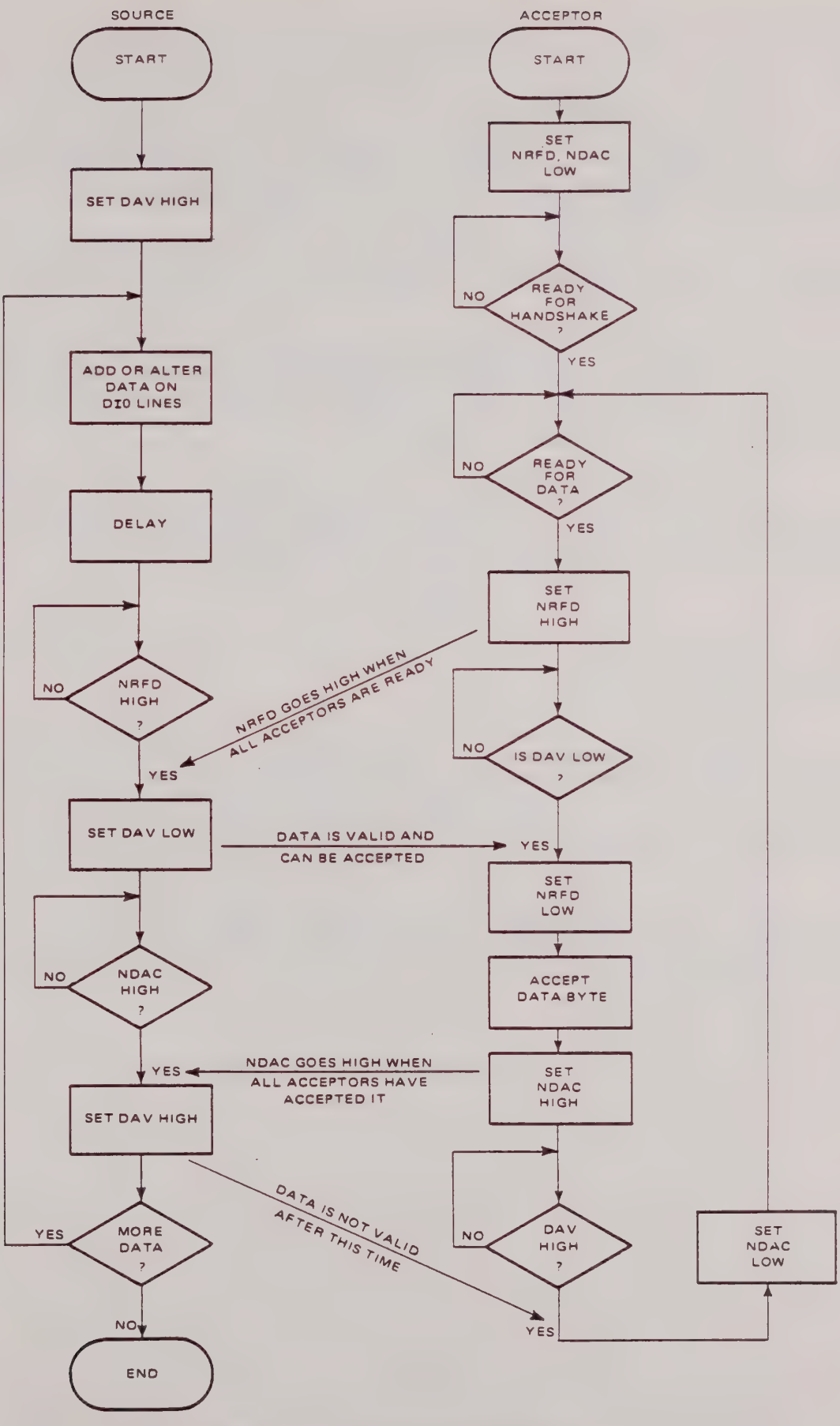


Figure 4.4 - Handshake Flow Chart

4.3 GPIB ADDRESS ASSIGNMENT

4.3.1 The 1995/1996 must be assigned an address as a bus member when operating in a GPIB system. Assigning an address to the counter permits it to be "called up" by the system controller or other resident bus device without interfering with it.

4.3.2 Table 4.2 provides the available numbers for programming the counter's GPIB address and determining the various talk/listen address codes used in programming the controller.

4.3.3 To program the counter's address, use key sequence ⟨number⟩ SHIFT STORE ADDR where ⟨number⟩ is any number from 00 through 30. To recall the counter's address, use key sequence SHIFT RECALL ADDR. To change the counter's address, simply enter the new address. The new GPIB address will overwrite the old one. The counter will automatically return to its measurement mode.

4.3.4 To enable the Talk-Only mode, just enter 99 as the new address. This will not affect the counter's selected bus address (00 through 30), but will set the unit to respond only as a talker (see Subsection 4.5.2 for details). To exit the Talk-Only mode, just reenter the counter's selected bus address or a new bus address.

NOTE:

Printed instructions for address programming are found on the rear panel just to the right of the GPIB connector.

4.3.5 Observe in the table that the far right column lists the number addresses that can be assigned to the counter. Once an address has been selected and stored, the controller may then address the 1995/1996 as a talker/listener by transmitting the appropriate ASCII character on the data lines. The "DATA LINES" column of the table shows the 7-bit binary codes for every talk/listen address assigned to the counter. The controller transmits these codes to the counter to establish its talker/listener status.

4.3.6 Note also in the table that there are two address codes for each GPIB address number. Each code represents a different ASCII character. For example, if an address of 02 is assigned to the counter, the talk address is ASCII character B and the listen address is ASCII character ". The only difference in the binary code in each case is the state of data lines D6 and D7.

4.3.7 The counter is preset at GPIB address 03 when shipped.

Table 4.2 - 1995/1996 GPIB Address and Talk/Listen Codes

ASCII CHARACTERS		DATA LINES							DECIMAL ADDRESS
		D_7	D_6	D_5	D_4	D_3	D_2	D_1	
TALK	LISTEN	TALK	LISTEN	ADDRESS					
				16	8	4	2	1	
	SP	0	1	0	0	0	0	0	00
@		1	0	0	0	0	0	0	
	!	0	1	0	0	0	0	1	01
A		1	0	0	0	0	0	1	
	"	0	1	0	0	0	1	0	02
B		1	0	0	0	0	1	0	
	#	0	1	0	0	0	1	1	03
C		1	0	0	0	0	1	1	
	$	0	1	0	0	1	0	0	04
D		1	0	0	0	1	0	0	
	%	0	1	0	0	1	0	1	05
E		1	0	0	0	1	0	1	
	&	0	1	0	0	1	1	0	06
F		1	0	0	0	1	1	0	
	' (APOSTROPHE)	0	1	0	0	1	1	1	07
G		1	0	0	0	1	1	1	
	(	0	1	0	1	0	0	0	08
H		1	0	0	1	0	0	0	
	)	0	1	0	1	0	0	1	09
I		1	0	0	1	0	0	1	
	*	0	1	0	1	0	1	0	10
J		1	0	0	1	0	1	0	
	+	0	1	0	1	0	1	1	11
K		1	0	0	1	0	1	1	
	,	0	1	0	1	1	0	0	12
L		1	0	0	1	1	0	0	
	-	0	1	0	1	1	0	1	13
M		1	0	0	1	1	0	1	
	.	0	1	0	1	1	1	0	14
N		1	0	0	1	1	1	0	
	/	0	1	0	1	1	1	1	15
O		1	0	0	1	1	1	1	

Table 4.2 - 1995/1996 GPIB Address and Talk/Listen Codes (Cont'd)

ASCII CHARACTERS		DATA LINES							DECIMAL ADDRESS
		D_7	D_6	D_5	D_4	D_3	D_2	D_1	
TALK	LISTEN	TALK	LISTEN	ADDRESS					
				16	8	4	2	1	
	Ø	0	1	1	0	0	0	0	16
P		1	0	1	0	0	0	0	
	1	0	1	1	0	0	0	1	17
Q		1	0	1	0	0	0	1	
	2	0	1	1	0	0	1	0	18
R		1	0	1	0	0	1	0	
	3	0	1	1	0	0	1	1	19
S		1	0	1	0	0	1	1	
	4	0	1	1	0	1	0	0	20
T		1	0	1	0	1	0	0	
	5	0	1	1	0	1	0	1	21
U		1	0	1	0	1	0	1	
	6	0	1	1	0	1	1	0	22
V		1	0	1	0	1	1	0	
	7	0	1	1	0	1	1	1	23
W		1	0	1	0	1	1	1	
	8	0	1	1	1	0	0	0	24
X		1	0	1	1	0	0	0	
	9	0	1	1	1	0	0	1	25
Y		1	0	1	1	0	0	1	
	:	0	1	1	1	0	1	0	26
Z		1	0	1	1	0	1	0	
	;	0	1	1	1	0	1	1	27
[		1	0	1	1	0	1	1	
	<	0	1	1	1	1	0	0	28
\		1	0	1	1	1	0	0	
	=	0	1	1	1	1	0	1	29
]		1	0	1	1	1	0	1	
	>	0	1	1	1	1	1	0	30
^		1	0	1	1	1	1	0	
NONE		ILLEGAL							31

4.4 INTERFACE MESSAGE REPERTOIRE and RESPONSE

4.4.1 Introduction

4.4.1.1 The 1995/1996 is equipped with a standard GPIB interface designed to meet IEEE-STD-488-1978 specifications. These specifications provide a definition of multiline interface messages, dividing them into two main groups:

a. Primary command group

b. Secondary command group

This counter includes only the primary commands in its interface repertoire.

4.4.1.2 The primary command group is further divided into four categories:

a. Listen address commands

b. Talk address commands

c. Addressed commands

d. Universal commands

4.4.2 Listen and Talk Address Commands

4.4.2.1 The counter is designed to include 31 listen and 31 talk addresses. (Table 4.2 lists these addresses.) The instrument responds to address messages as defined by the programmed GPIB address entered from the counter's front panel.

4.4.2.2 Listen Addresses

4.4.2.2.1 Receipt by the counter of a listen address makes it a listener. If previously addressed to talk, the counter ceases to be a talker. In Local mode, the counter reverts to its Remote state, provided the REN message is true.

4.4.2.3 Talk Addresses

4.4.2.3.1 Receipt by the counter of a talk address makes it a talker. If previously addressed to listen, the counter ceases to be a listener. If in Local mode, the counter will remain under local control.

4.4.2.4 Talk Addresses-Other Devices

4.4.2.4.1 If the counter was previously addressed to talk, then receives the talk address of another bus device, the 1995/1996 ceases to be a talker.

4.4.3 Addressed and Universal Commands

4.4.3.1 Table 4.3 lists the Addressed and Universal commands to which the 1995/1996 responds. These interface commands are recognized because they are sent with the ATN message as true. The following paragraphs describe the counter's response to each of these commands.

Table 4.3 - Addressed and Universal Commands

Message	Meaning	Hex Code	Decimal Equivalent	Data Line Code						
				7	6	5	4	3	2	1
GTL	Go To Local	01	1	0	0	0	0	0	0	1
SDC	Selected Device Clear	04	4	0	0	0	0	1	0	0
GET	Group Execute Trigger	08	8	0	0	0	1	0	0	0
LLO	Local Lock Out	11	17	0	0	1	0	0	0	1
DCL	Device Clear	14	20	0	0	1	0	1	0	0
SPE	Serial Poll Enable	18	24	0	0	1	1	0	0	0
SPD	Serial Poll Disable	19	25	0	0	1	1	0	0	1
UNL	Unlisten	3F	63	0	1	1	1	1	1	1
UNT	Untalk	5F	95	1	0	1	1	1	1	1

4.4.3.2 Go To Local (GTL)

4.4.3.2.1 Provided the counter is in remote and a listener, it reverts to local operation. The counter remains addressed to listen. It now operates by front-panel controls, until returned to remote control by receipt of the first byte of a device-dependent message. The decimal and hex equivalents are both 01. When in local, the SRQ LED is always off.

NOTE:

If the counter is in a function having no equivalent in local operation, upon receipt of a GTL command, it will default to home state conditions. These functions include: hardware ratios A/B, B/A, A/C, B/C; totalize A or B by gate time; and totalize A or B by D.

4.4.3.3 Selected Device Clear (SDC)

4.4.3.3.1 Provided the counter is in remote and a listener, it reverts to home state. The condition of the GPIB interface remains unchanged. The decimal and hex equivalents are both 04.

4.4.3.4 Group Execute Trigger (GET)

4.4.3.4.1 Provided the counter is a listener and no measurement is in progress, it executes a previously programmed measurement and, if the SRQ mask is set, issues an SRQ command at completion. The GET command permits several bus devices to simultaneously perform a number of different operations. (All bus members have been previously programmed to perform a function on receiving the GET command or trigger command.) The decimal and hex equivalents are both 08.

4.4.3.5 Local Lockout (LLO)

4.4.3.5.1 The counter responds to the LLO command regardless of its addressed state. The LLO command disables the LOCAL key on the front panel. By issuing a GTL command, the counter is returned to local control. However, if the counter is returned to remote operation, the local lockout condition is still active. The only way to deactivate the LLO condition is to turn off the counter.

4.4.3.6 Device Clear (DCL)

4.4.3.6.1 Same as the SDC command, except that all bus devices in remote are put in home state. The counter responds to this command regardless of its addressed state. The decimal and hex equivalents are 10 and 14, respectively.

4.4.3.7 Serial Poll Enable (SPE)

4.4.3.7.1 This command permits all bus members, including the counter, to set their SRQ line to binary 1, informing the controller that attention is required. For the 1995/1996, bit 7 of the status byte is set. Each bus member, having been made a talker, is then serially interrogated by the controller to determine which bus member(s) requested service and the purpose of each request. Bus members respond by transmitting their respective status bytes to the controller. All members respond to the SPE command regardless of their addressed state. The function and format of the 1995/1996's SRQ status byte is described in Subsection 4.7. The decimal and hex equivalents are 24 and 18, respectively.

4.4.3.8 Serial Poll Disable (SPD)

4.4.3.8.1 This command returns all bus members to normal operation after completion of a serial poll. All bus members respond to the SPD command regardless of their addressed state. If addressed to talk, a bus device will put its data output string on the GPIB, provided such data is available in its output buffer. The decimal and hex equivalents are 25 and 19, respectively.

4.4.3.9 Untalk (UNT)

4.4.3.9.1 This universal command instructs all talkers, including the counter, to return to their untalk or talker-idle state. All bus members are also removed from their talker state whenever a talk address other than their own is received. In the Untalk state, the front-panel ADDR LED is turned off. The decimal and hex equivalents are 9 and 5F, respectively.

4.4.3.10 Unlisten (UNL)

4.4.3.10.1 This universal command instructs all listeners, including the counter, to return to their unlisten or listen-idle state. In the Unlisten state, the front-panel ADDR LED is turned off. The decimal and hex equivalents are 63 and 3F, respectively.

4.5 GPIB OPERATING MODES

4.5.1 Introduction

4.5.1.1 Before operating the counter on the GPIB, ensure that the instrument has been assigned its correct bus address (see Subsection 4.3) and that the correct AC line voltage has been selected (see Subsection 2.7.3). The last instruction is especially important if the 1995/1996 is being used for the first time or at a new location.

4.5.1.2 The 1995/1996 can be operated on the GPIB in either its Talk-Only or Addressed mode.

4.5.2 Talk-Only Mode

4.5.2.1 To set the counter in this mode, enter counter address 99.

4.5.2.2 The Talk-Only mode may be used in systems not having a controller. Such a system permits remote reading of counter measurement data, however, the instrument is controlled from the front panel (see Section 3).

4.5.2.3 The counter determines the rate at which measurements are made. The output buffer is updated at the end of each measurement cycle, overwriting the previous measurement data if not transferred to the listener.

4.5.2.4 The listener triggers the transfer of data from the counter. The counter's output buffer is cleared when data transfer is completed.

4.5.2.5 Differences between the measurement rate and data transfer rate are resolved as follows:

a. If data transfer is in progress at the end of a measurement cycle, updating of the output buffer is delayed. Data transferred will correspond to the previous measurement cycle

b. If data transfer trigger occurs during a measurement cycle and the output buffer is empty, data transfer is delayed until the buffer is updated. Data transferred will then correspond to the latest measurement cycle

c. If a measurement cycle is completed before any byte from the previous cycle has been transferred to the listener, the buffer will be updated.

4.5.2.6 a. The gate time can be controlled by selecting an appropriate display resolution or setting a specific gate time

b. A time interval delay can be set using the range of 200 ns to 100 s

c. The counter can be operated in the Hold mode (single-shot measurements). Readings are displayed indefinitely in Hold until the RESET key is pressed, initiating a new measurement cycle

4.5.3 Addressed Mode

4.5.3.1 In the Addressed mode, all of the counter's functions (except POWER ON/OFF) can be controlled using device-dependent commands (see Subsection 4.8.2). These commands are sent over the GPIB after the counter has been addressed to listen. Completed measurement readings and counter status information are then read back over the bus after the counter has been addressed to talk. If the counter is addressed to talk when its output buffer is empty, no data transfer will occur and bus activity will cease. Data transfer will start again after the output buffer is updated at the completion of the next measurement cycle.

4.6 OUTPUT MESSAGE FORMAT (TALKER)

4.6.1 Introduction

4.6.1.1 Refer to Tables 4.4 to 4.7 for the following:

a. Table 4.4 - Message formats for the various 1995/1996 measurements and "one-time" (recall) outputs

b. Table 4.5 - Basic 23-byte output format

c. Table 4.6 - Alpha header output codes

d. Table 4.7 - High speed data output format

4.6.1.2 Measurement units should be assumed as hertz, seconds, degrees, or a ratio, depending on commands previously sent to the counter.

NOTE:

An SRQ message is not sent by data recall from the counter's stores.

Table 4.4 - Measurement and "One-Time" Output Formats

Output	Format
Measurement Outputs (see NOTE 1)	
Reading (with/without math, statistics)	A single 23-byte output-see Table 4.5
Standard Deviation and Mean	A double 23-byte output (i.e., two numeric fields, with/without headers, separated by a comma, and terminated by a CRLF)
Mean, High, and Low	A triple 23-byte output (i.e., three numeric fields, with/without headers, separated by commas, and terminated by a CRLF)
"One-Time" (Recall) Outputs (see NOTE 2)	
Data Recall (e.g., gate time, math constants, TI delay, and calibration constants)	A single 23-byte output-see Table 4.5
A and B Trigger Levels	A double 23-byte output (i.e., two numeric fields, with/without headers, separated by a comma, and terminated by a CRLF)
A and B Trigger Peaks (V max., V min)	A double 23-byte output (i.e. two numeric fields, with/without headers, separated by a comma, and terminated by a CRLF)
Learn Mode	A 200-byte ASCII-formatted output sent and readable only by the counter
Error Message, Identification, or String	Variable number of ASCII bytes, null, CR, and LF

NOTE 1:

The statistics and math outputs will be the result of the calculation with the alpha header code of the function measurement. For special output (SO1), the first measurement will have the alpha header code of the normal measurement, and the second and third readings will have the alpha codes from Table 4.6 (e.g., "H" header for High).

NOTE 2:

"One-Time" (recalled) data commands must be entered in outputs by themselves. (Refer to Input Commands tabulated in Subsection 4.8 and identified with an asterisk(*). When data is recalled, it will be placed in the buffer only once. The output buffer will then default to the previously entered measurement only after the recalled data is read by the controller or the counter is programmed with a new command. Recalled data will not generate an SRQ command.

Table 4.5 - Basic 23-Byte Output Format

Byte No.	Interpretation	Permitted ASCII Characters	Notes
1	Space		Spaces are transmitted
2	Alpha header code (See Table 4.6). If turned off using the HD0 command, this byte will be a space		
3	Space		
4	Measurement Sign	+ or -	
5	Most significant digit	0 to 9	Bytes 5 to 19 will always include 14 digits (i.e., the mantissa) and decimal point. The numeric field (bytes 4 to 23) is in scientific notation. Zero's are added as necessary in the less significant digit positions.
6	Digit	0 to 9 or .	
7	↓	↓	
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19	↓	↓	
20	Exponent indicator	E	
21	Exponent Sign	+ or -	
22	More significant digit	0 to 9	
23	Less significant digit	0 to 9	
	CR or ,		Commas are used to separate multiple numeric field outputs.
	(LF)		Used as a final output terminator. CRLF is the final output terminator in the buffer. The EOI is always given with LF. No EOI is given if high speed mode is enabled

Table 4.6 - Alpha Header Output Codes

Function/Operation	Header	Function/Operation	Header
Frequency C	F	Ratio B/A (software)	R
Frequency A	F	Ratio C/A (software)	R
Period A	S	Ratio A/B (hardware)	R
Time Interval A→B	S	Ratio B/A (hardware)	R
Time Interval A→B		Ratio C/B (hardware)	R
with delay	T	Ratio C/A (hardware)	R
Totalize A by B	T	Rise Time B	R
Ratio A/B (software)	R	Fall Time B	S
Ratio C/A (software)	R	Positive Pulse Width B	S
Rise Time A	S	Positive Pulse Width B	S
Fall Time A	S	with delay	S
Positive Pulse Width A	S	Negative Pulse Width B	S
Positive Pulse Width A		Negative Pulse Width B	
with delay	S	with delay	S
Negative Pulse Width A	S	Phase B rel A	P
Negative Pulse Width A		Duty Cycle B	U
with delay	S	Slew Rate B	S
Phase A rel B	P	Display Mean	M
Duty Cycle A	U	Display High	H
Slew Rate A	S	Display Low	L
Additional Functions		Recall A trigger level	A
Frequency B	F	Recall B trigger level	B
Period B	S	Recall Peaks-V max, A or B	V
Time Interval B→A	S	Recall X (Offset)	X
Time Interval B→A		Recall Y (Normalize)	Y
with delay	S	Recall Z (Scale)	Z
Manual Totalize B (software)	T	Recall Calibration	
Manual Totalize B (software)	T	Constants	C
Totalize B by A	T	Recall n value	N
A by D	T	Recall Gate Time	G
B by D	T	Recall Delay Time	D
A by gate	T	Transmit Time Out	O

NOTES:

1. In general, the following Header Codes **precede** the listed functions:

   F-Frequency measurements
   S-Time measurements (seconds); rise/fall times; pulse width
   P-Phase measurements
   R-Ratio measurements
   U-Duty Cycle measurements
   T-Totalize measurements

Table 4.7 - High Speed Data (ASCII) Output

ASCII Format	Value Range
b#0.nnnnnnnnnnnnnnnE#ddCRLF	0.1 to 0.999999999999999
b#N.nnnnnnnnnnnnnnnE#ddCRLF	1.0 to 9.99999999999999
b#NN.nnnnnnnnnnnnnnnE#ddCRLF	10.0 to 99.9999999999999
b#NNN.nnnnnnnnnnnnnnnE#ddCRLF	100.0 to 999.999999999999
•	•
•	•
•	•
b#NNNNNNNNNNNNNNNN.E#ddCRLF	1000000000000000.0 to 9999999999999999.9
b#N.nnnnnnnnnnnnnnnE#ddCRLF	Any other number
where: b = blank space	• = decimal point
# = - or +	E = exponent
N = digit	d = ten's exponent digit
n = the fractional part	CR = carriage return
	LF = line feed

NOTE:

No SRQ requests are generated when in the high-speed mode.

4.7 SERVICE REQUEST (SRQ) STATUS BYTE

4.7.1 Introduction

4.7.1.1 An SRQ may be transmitted by the 1995/1996 whenever:

a. An error occurs

b. A measurement is completed

c. A timeout occurs

4.7.1.2 The seventh bit in the SRQ status byte is set to a binary 1. One other bit, indicating the status or type of service requested, is also set. If an SRQ is not enabled, this other bit is still set - even if the seventh bit is not. Refer to Table 4.8 which shows the format for the counter's status byte. The front-panel SRQ LED lights when the SRQ is asserted.

Table 4.8 - Status Byte Format

Bit No.	Bit Weight	Function
1 (LSB)	1	Unused
2*	2	1 = External frequency reference in use; no SRQ issued
3	4	Unused
4**	8	1 = Timeout has occurred
5*	16	1 = Reading ready; no SRQ issued for recalled data; bit is cleared when measurement is output or when buffer is flushed
6**	32	1 = Error condition exists
7	64	1 = Service requested
8	128	Unused

* = Serial poll alone will not clear this bit
** = Serial poll alone will clear this bit

4.7.1.3 The counter's SRQ status byte can be conveniently masked to indicate the type of information. This feature is achieved using the Service Request Mask command (QMn) where the value of n is the loaded bit weight (i.e., binary value) - see Table 4.8 - in the range of 0 to 255.

EXAMPLE:

If the user wants an SRQ message when (1) a timeout has occurred, and (2) an error condition exists, the correct SRQ Mask command that would generate this would be QM40 (8 + 32). Then by reading the SRQ status byte, bits 4 and 6 can be tested to determine which one caused the SRQ message.

4.7.1.4 The Service Request Mask command QM0 will disable all SRQ messages.

4.8 INPUT COMMANDS (LISTENER)

4.8.1 Introduction

4.8.1.1 The 1995/1996 responds to device-dependent commands in a "deferred" manner. This means that the GPIB interface continues to accept commands until the terminating character (LF) is received, then the entire string is executed. There is no "immediate" mode in which commands are obeyed as they are received.

4.8.1.2 The counter clears all data in its output buffer upon receiving a device-dependent command. Recalled data and single measurements, therefore, should be read immediately after the command is sent to program the counter.

4.8.2 Device-Dependent Commands

4.8.2.1 When the counter is addressed to listen, it can be controlled (except POWER ON/OFF) by device-dependent commands. These commands are tabulated below:

a. Table 4.10 - Counter Initialize Code
b. Table 4.12 - Measurement Function Codes
c. Table 4.15 - Math Codes
d. Table 4.16 - Memory Codes
e. Table 4.17 - Statistics Codes
f. Table 4.18 - Gate/Delay Codes
g. Table 4.19 - Input Control Codes
h. Table 4.20 - Arming Codes
i. Table 4.21 - Learn Codes
j. Table 4.22 - Measurement Mode Codes
k. Table 4.23 - Miscellaneous Codes
l. Table 4.24 - Calibration Codes

4.8.2.2 In general, device-dependent commands are executed sequentially beginning with the first one sent, and ending with the last. However, to ensure expected results, it is recommended that the following commands be sent in a separate string: IN (Initialize), RE (Start New Measurement), SMn (Non-Vol Store to Memory, 0-9), and TG1, TG2, TG3 (Output Trigger/Peak Levels).

4.8.2.3 If more than one command is to be sent, no delimiters are required. If necessary, commas, spaces, and semicolons may be included as delimiters in the command strings for clarification without affecting counter operation. Alpha characters in a command string may be upper or lower case. Each command string must be followed by an end-of-string terminator group. Table 4.9 summarizes the valid terminator groups.

Table 4.9 - Valid Terminators

1	2	3
LF	CRLF	CRLF EOI True

4.8.2.4 Table 4.10 provides the counter initialize code for the 1995/1996.

Table 4.10 - Counter Initialize Code

Function	Code
Initializes counter functions/settings to home state	IN

4.8.2.5 Some of the device-dependent commands in the following tables require additional numerical input data. Such numerical input succeeds its command. "One-time" (recall) outputs are noted by an asterisk(*). Finally, home-state commands (at power-on, after an IN command, or after a diagnostic IST command) are underlined. Refer to Table 4.11 as required for the numerical input format.

Table 4.11 - Numerical Input Format

Byte No.	Interpretation	Permitted ASCII Characteristics
1	Mantissa	+ or -
2	Most significant digit	0 to 9
3	Digit	↓
4	↓	
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16	↓	
17	Least significant digit	↓
18	Exponent indicator	E
19	Exponent sign	+ or -
20	Digit	0 to 9
21	Digit	0 to 9

NOTE 1:

The valid syntax for the numerical input value tabulated above is:

[+ or -]<H digits>[.]<I digits>[E[+ or -]<1 or 2 digits>]
where 1<= H + I<= 16. Characters inside the brackets are optional.

This format is valid for all numerical inputs including measurement functions (e.g., FN10=FN1E1). For enable/disable (i.e., toggle) commands (e.g., CK0/CK1 command), zero (CK0) will turn the command off; and **any** other valid numeric input (CK+1, CK55.09e-7) will turn the command on.

NOTE 2:

The use of a floating point decimal increases the number of characters in the string from 16 to 17.

NOTE 3:

Leading zeros in the mantissa and/or the exponent are ignored.

NOTE 4:

Byte one may be omitted and a positive mantissa assumed.

NOTE 5:

Bytes 2 to 17 may have up to 16 significant digits and a decimal point. The decimal point is not essential. After entry of 16 digits (without a decimal point), additional digits are ignored and a GPIB programming error is generated. Non-significant zeros will still increase the power-of-ten stored. Also, if fewer than 16 digits are required, unused bytes may by omitted.

NOTE 6:

Spaces or nulls are always ignored.

NOTE 7:

Bytes 18 to 21 (exponent group) may be omitted. Also, byte 19 may be omitted or transmitted as a space (a positive exponent should be assumed in either case).

NOTE 8:

Numbers may be terminated by one of the same terminators used for output messages, or by another device-dependent message.

NOTE 9:

Units are implied; volts for trigger levels, seconds for gate/delay times.

4.8.2.6 Table 4.12 presents the measurement function codes for the 1995/1996. Functions FN1 through FN18 are front-panel selections. Functions FN19 through FN45 are selected either as front-panel special functions or are unavailable from the keyboard. When the controller programs one of the functions (FN1-FN45), external arming, external gating, and synchronized window auto-trigger (SWAT) are turned off if invalid for the new function. If an invalid channel is programmed for a function, the command is ignored and arming, gating, or SWAT default to the off condition. No error is generated for this type of programming.

Table 4.12 - Measurement Function Codes

Function	Code
Frequency C	FN1
Frequency A	FN2
Period A	FN3
Time Interval A B	FN4
Time Interval A B with delay	FN5
Totalize A by B	FN6
Totalize A by B with delay	FN7
Ratio A/B (software)	FN8
Ratio C/B (software)	FN9
Rise Time A	FN10
Fall Time A	FN11
Positive Pulse Width A	FN12
Positive Pulse Width A with delay	FN13

Table 4.12 - Measurement Function Codes (Cont'd)

Function	Code
Negative Pulse Width A	FN14
Negative Pulse Width A with delay	FN15
Phase A rel B	FN16
Duty Cycle A	FN17
Slew Rate A	FN18
Frequency B	FN19
Period B	FN20
Time Interval B→A	FN21
Time Interval B→A with delay	FN22
Manual Totalize A	FN23
Manual Totalize B	FN24
Totalize B by A	FN25
B by A with delay	FN26
A by D (TTL)	FN27
B by D(TTL)	FN28
A by gate time	FN29
B by gate time	FN30
Ratio B/A (software)	FN31
C/A (software)	FN32
A/B (hardware)	FN33
B/A (hardware)	FN34
C/A (hardware)	FN35
C/B (hardware)	FN36
Rise Time B	FN37
Fall Time B	FN38
Positive Pulse Width B	FN39
Positive Pulse Width B with delay	FN40
Negative Pulse Width B	FN41
Negative Pulse Width B with delay	FN42
Phase B rel A	FN43
Duty Cycle B	FN44
Slew Rate B	FN45

NOTE 1:

Either "FU" or "FN" can be used for the above measurement function codes.

NOTE 2:

All measurement function codes are mutually exclusive.

NOTE 3:

For FN23 and FN24 (Manual Totalize), refer to the Gate codes to start and stop a measurement.

4.8.2.7 Table 4.13 provides the predefined (forced) setting by functions. The Phase Angle, Duty Cycle, and Slew Rate settings are automatically selected, but can be modified by the controller. In addition, for programming selection of Duty Cycle and Slew Rate settings, use the following guidelines:

a. To change from positive Duty A(B) to negative Duty A(B), program slope A(B) to minus using control code AS1

b. To change from positive Slew Rate A(B) to negative Slew Rate A(B), program slope A(B) to minus using control code AS1

NOTE:

The COMMON settings shown in the table for Phase Angle, Duty Cycle, and Slew Rate cannot be modified by the controller.

Table 4.13 - Predefined (Forced) Front-Panel Settings

Function	Common	Slope A	Slope B	DC (A and B)	Auto-Trig A	Auto-Trig B
Rise Time A	On	+	+	DC	On	On
Rise Time B	On	+	+	DC	On	On
Fall Time A	On	-	-	DC	On	On
Fall Time B	On	-	-	DC	On	On
Pos. Pulse Width A	On	+	-	DC	On	On
Pos. Pulse Width B	On	-	+	DC	On	On
Neg. Pulse Width A	On	-	+	DC	On	On
Neg. Pulse Width B	On	+	-	DC	On	On
Phase A rel B	Off	+	+	DC	On	
Phase B rel A	Off	+	+	DC	On	
Duty Cycle A	On	+	-	DC	On	
Duty Cycle B	On	-	+	DC		On
Slew Rate A	On	+	+	DC	On	
Slew Rate B	On	+	+	DC		On
Man. Totalize A (software)	On					Off
Man. Totalize B (software)	On				Off	
Totalize A by Gate	On					Off
Totalize B by Gate	On				Off	
Totalize A by D	On					Off
Totalize B by D	On				Off	

NOTE 1:

When Common mode is on and the function is controlled by Input A (e.g., Frequency A, Ratio A/B), Input B autotrigger and attenuator commands are disregarded. Also in this mode, Input B levels will be ignored if Input A (and therefore B) auto-trigger is on. Similarly when the Common mode is on, and the function is controlled by Input B, Input A auto-trigger and attenuator commands are disregarded. No error is generated for this kind of inconsistent programming.

NOTE 2:

The auto-trigger must be turned off before entering a manual trigger level.

4.8.2.8 Table 4.14 indicates the valid channels for external arming and gating by function. External arming and gating are mutually exclusive commands.

Table 4.14 - Valid Channels for External Arming/Gating

Function	Valid Channels
Frequency C	A, B, D-TTL, D-Zero Crossing
Frequency A, Period A	B, D-TTL, D-Zero Crossing
Frequency B, Period B	A, D-TTL, D-Zero Crossing
Time Interval A to B†; B to A†	D-TTL, D-Zero Crossing
Totalize A by B†; B by A†	
Totalize A by internal gate†; B by internal gate†	
Rise Time A†; Rise Time B†	
Fall Time A†; Fall Time B†	
Positive Pulse Width A†; Positive Pulse Width B†	
Negative Pulse Width A†; Negative Pulse Width B†	
Slew Rate A†, Slew Rate B†	
Hardware Ratio A/B; Hardware Ratio B/A	
Hardware Ratio C/B; Hardware Ratio C/A	
Software Ratio A/B; Software Ratio B/A	None
Software Ratio C/B; Software Ratio C/A	
Duty Cycle A; Duty Cycle B	
Phase A rel B; Phase B rel A	
Totalize A by D; Totalize B by D	
Manual Totalize A; Manual Totalize B	

NOTE 1:

The dagger (†) indicates a function for which external arming is valid; external gating is invalid.

NOTE 2:

Valid channels for Synchronous Window Auto-Trig(SWAT) are identical to those for external arming/gating, except for Frequency C. SWAT is disallowed in Frequency C.

NOTE 3:

If an invalid channel is programmed for a function, the command is ignored and arming, gating, or SWAT default to the off condition. No error is generated for this type of programming.

Table 4.15 - Math Codes

Function	Code
Disable Math	MD0
Enable Math	MD1
Store Offset ⟨value⟩ (X)	MO ⟨value⟩ (home state=0)
Recall Offset	RO *
Store Normalize ⟨value⟩ (Y)	MN ⟨value⟩ (home state=1)
Recall Normalize	RN *
Store Scale ⟨value⟩ (Z)	MS ⟨value⟩ (home state=1)
Recall Scale	RS *

NOTE:

The math constant range for offset X, normalize Y, and scale Z is: ±0.000000001E-9 to ±9999999999E9.

Table 4.16 - Memory Codes

Function/Description	Code
Non-vol memory recall from 0-9	RM0-9
Non-vol memory store from 0-9	SM0-9 (see Notes)
NOTE 1: SM0-9 requires a 2-second wait after programming. **NOTE 2:** If the counter is in a function having no equivalent in local operation, this function cannot be stored in non-vol memory. These functions include: hardware ratios A/B, B/A, A/C, B/C; totalize A or B by gate time; and totalize A or B by D.	
Recall calibration constants:	
DAC constants	
Input A slope multiplier	RC10*
Input A slope offset	RC11*
Input B slope multiplier	RC12*
Input B slope offset	RC13*
Input path constants	
Input A start, hyst. low, offset	RC14*

Table 4.16 - Memory Codes (Cont'd)

Function/Description	Code
Input A start, hyst. low, hysteresis	RC15*
Input A start, hyst. high, offset	RC16*
Input A start, hyst. high, hysteresis	RC17*
Input A stop, hyst. low, offset	RC18*
Input A stop, hyst. low, hysteresis	RC19*
Input A stop, hyst. high, offset	RC20*
Input A stop, hyst. high, hysteresis	RC21*
Input B start, hyst. low, offset	RC22*
Input B start, hyst. low, hysteresis	RC23*
Input B start, hyst. high, offset	RC24*
Input B start, hyst. high, hysteresis	RC25*
Input B stop, hyst. low, offset	RC26*
Input B stop, hyst. low, hysteresis	RC27*
Input B stop, hyst. high, offset	RC28*
Input B stop, hyst. high, hysteresis	RC29*
Time Interval constants	
A-start, B-stop; A-positive, B-negative	RC30*
A-start, A-stop; A-negative, B-positive	RC31*
B-start; A-stop; A-positive, B-negative	RC32*
B-start, B-stop; A-negative, B-positive	RC33*

Table 4.17 - Statistics Codes

Function/Description	Code
Store n value = 100	SV0
Store n value = 1000	SV1
Store n value, where value = 2 to 9999	SV <value>
Recall n value	RV *
Disable standard deviation	SD0
Enable standard deviation	SD1 - turns off mean
Disable mean	SA0
Enable mean	SA1 -turns off standard deviation
Special output disable	SO0
Special output enable	SO1 -and enable standard deviation (SD1) will output standard deviation and mean; and enable mean (SA1) will output mean, high, and low

Table 4.18 - Gate/Delay Codes

Function/Description	Code
Gate Open - used only to start software manual totalize	GO
Gate Close - used only to stop software manual totalize	GC
Gate Time Adjust - enters gate time ⟨value⟩ where ⟨value⟩range = 200ns to 100 s; home state value = 10 ms; and a value of 0 = a single event reading	GA ⟨value⟩
Recall Gate Time	RG *
Delay Time Adjust - enters delay time ⟨value⟩ where ⟨value⟩range = 200 ns to 100 s; home state value = 1 ms	DA ⟨value⟩
Recall Delay Time	RD *

4.8.2.9 To use software manual totalize (FN23 or FN24), enter the following 3 commands in order:

a. FN23 ⟨CR LF⟩ - sets up the manual totalize (A) function and turns on the Hold LED

b. GO ⟨CR LF⟩ -opens the gate to start the readings. Data can be read from the counter at this point

c. GC ⟨CR LF⟩ - closes the gate, turns on the Hold LED, and puts the last reading in the buffer. The last reading can be read from the counter

To restart the measurement at zero enter:

RE GO ⟨CR LF⟩

To continue the measurement count enter:

GO ⟨CR LF⟩

NOTE:

If a new function is entered, the single measurement mode will still be in effect.

Table 4.19 - Input Control Codes

Function/Description	Code
Trigger Level A Set	AT ⟨value⟩
Trigger Level B Set - home state value is 0	BT ⟨value⟩
Auto-Trig off (A and B)	AU0
Auto-Trig on (A and B)	AU1
Auto-Trig Input A off	AU2
Auto-Trig Input A on	AU3
Auto-Trig Input B off	AU4
Auto-Trig Input B on	AU5
Continuous Auto-Trig	ST0
Single Auto-Trig - use AU1, 3, or 5 to start a single autotrigger process	ST1
Coupling Input A to DC	AA0
Coupling Input A to AC	AA1
Coupling Input B to DC	BA0
Coupling Input B to AC	BA1
Slope Input A Positive	AS0
Slope Input A Negative	AS1
Slope Input B Positive	BS0
Slope Input B Negative	BS1
Attenuation Input A X 1	AX0
Attenuation Input A X 10	AX1
Attenuation Input A X 50	AX2
Attenuation Input B X 1	BX0
Attenuation Input B X 10	BX1
Attenuation Input B X 50	BX2
Impedance Input A to 1 Mohm	AZ0
Impedance Input A to 50 ohms	AZ1
Impedance Input B to 1 Mohm	BZ0
Impedance Input B to 50 ohms	BZ1
Filter Input A off	AF0
Filter Input A on	AF1
Filter Input B off	BF0
Filter Input B on	BF1
Hysteresis off	SE0
Hysteresis on	SE1
Common off (Separate mode)	CM0
Common on	CM1

Table 4.20 - Arming Codes

Function/Description	Code
External Arming Disable - internal arming enabled is home state	XA0
External Arming Input A	XA1
External Arming Input B	XA2
External Arming Input D - Zero Crossing	XA3
External Arming Input D - TTL	XA4
Arming Slope Positive	XA5
Arming Slope Negative	XA6
External Gate Disable - internal gate enabled is home state (see code GA)	XG0
External Gate Input A	XG1
External Gate Input B	XG2
External Gate Input D-Zero Crossing	XG3
External Gate Input D-TTL	XG4
Gate Slope Start-Negative; Stop-Negative	XG5
Gate Slope Start-Positive; Stop-Negative	XG6
Gate Slope Start-Negative; Stop-Positive	XG7
Gate Slope Start-Positive; Stop-Positive	XG8
Synchronous Window Auto-Trig (SWAT)	
SWAT Disable	XS0
SWAT Input A	XS1
SWAT Input B	XS2
SWAT Input D-Zero Crossing	XS3
SWAT Input D-TTL	XS4
SWAT Slope Start-Negative; Stop-Negative	XS5
SWAT Slope Start-Positive; Stop-Negative	XS6
SWAT Slope Start-Negative; Stop-Positive	XS7
SWAT Slope Start-Positive; Stop-Positive	XS8

Table 4.21 - Learn Codes

Function/Description	Code
Send Machine Setup - Learn	SL *
Receive Machine Setup - Learn	RL <total machine state string-200 ASCII bytes>; string is readable only by the counter

Table 4.22 - Measurement Mode Codes

Function/Description	Code
Continuous Reading Mode	MM0
Single Reading Mode-use RE code to trigger a new measurement	MM1

Table 4.23 - Miscellaneous Codes

Function/Description	Code
Check Off Check On	CK0 or CH0 CK1 or CH1
Front Panel Display Disable (turns off front panel measurement display) Front Panel Display Enable	DR0 DR1
Turns Off Prefix Output Header Turns On Prefix Output Header (e.g., "F" for frequency)	HD0 HD1
High Speed Output Disable-defaults to previous autotrigger mode (single/continuous) High Speed Output Enable-forces continuous measurement mode, turns off statistics, takes single-shot auto-trigger, and no SRQ is given. No data can be recalled at this time	HS0 HS1
Transmit Hardware Identification-that is, "RD 1995" or "RD 1996" Transmit Software Identification version that is, 2.1 or other number Internal Self Test-output of <space CR LF> means a successful test. Otherwise, outputs an error message. Counter returns to power-up state on exit	ID0 * ID1 * IST
Set SRQ Mask-where <value>=0 to 255; home state=255; and QM0 code disables all SRQ commands	QM<value>
Start New Measurement-triggers new reading in single measurement mode	RE
Program Timeout, Gate Closed home state value is 500 seconds (see Note 2)	TC<value>
Program Timeout, Gate Open where the home state value is 500 seconds; <value>=1 to 500 seconds(see Note 2)	TO<value>
Transmit Error Code-outputs <space CR LF> if no errors exist	TE *
Output Trigger Levels A and B (see Note 3)	TG1 *

Table 4.23 - Miscellaneous Codes (Cont'd)

Function/Description	Code
Output Peak Levels A (V_{max}, V_{min}) - auto-trigger A turned off (see Note 3)	TG2 *
Output Peak Levels B (V_{max}, V_{min}) - auto-trigger B turned off (see Note 3)	TG3 *
Transmit Timeout Value-total abort time is (TO +GA <value>+ TC) or if delay active (TO + DA <value> + TC), or if externally gated (TO + TC + 100 seconds)	TV *

NOTE 1:

Information for the following codes in the above table is not stored in non-vol memory: DR0, DR1; HD0, HD1; HS0, HS1; QM <value>; TC <value>,TO <value>; TV.

NOTE 2:

Program Timeout, Gate Closed refers to the time that the counter will wait for the measurement gate to close prior to issuing a timeout error. Program Timeout, Gate Open refers to the time that the counter will wait, upon receipt of trigger, for the measurement gate to open prior to issuing a timeout error.

NOTE 3:

For the TG1, TG2, and TG3 codes: if in single measurement mode (or single autotrigger mode), initiate the measurement (or trigger) first, then send the command to output trigger levels. This ensures the output of trigger levels of measurement just taken.

Table 4.24 - Calibration Codes

Function/Description		Code
NOTE 1: Each of the eight commands listed below must be on a single line. See Section 5 of this manual for the calibration procedure.		
Step 1		CAL
Step 2	Set start and stop DACs to the maximum positive voltage	CLHI
	Set start and stop DACs to the maximum negative voltage	CLLO
Step 3	Start DAC positive voltage (+X.XXXX) Stop DAC positive voltage (+X.XXXX) Start DAC negative voltage (-X.XXXX) Stop DAC negative voltage (-X.XXXX)	CLTH <Vstart-high> CLPH <Vstop-high> CLTL <Vstart-low> CLPL <VStop-low>
NOTE 2: At this point, "CAL" is shown on the main display. About five minutes later, "CAL donE" is displayed when the calibration is finished. Calibration values may now be stored to non-vol memory by holding the front-panel calibration button in and sending the CLST command.		
Step 4	Stores values to non-vol memory	CLST
NOTE 3: Upon successful completion of non-vol store, a "donE" message is displayed, a <space CR LF> GPIB output is given, and the calibration button can be released. If at any point, there is an error (e.g., syntax, calibration), the entire procedure must be repeated starting with Step 1.		

4.9 GPIB ERRORS

4.9.1 When an error occurs, an SRQ message will be generated and the SRQ LED turned on. Should multiple errors occur, only the latest error is saved. An error will be cleared and the SRQ LED turned off when the controller transmits a new command string to the counter. To read the error message, send a TE (Transmit Error) command immediately after the error occurs.

4.9.2 Table 4.25 below lists the GPIB error messages and numbered codes. The numbered error codes are in the form "Error NN" where NN is a 2-digit code.

Table 4.25 - GPIB Error Messages and Codes

Message/Code Number	Error
ALPHA SYNTAX ERROR	Alpha syntax error while parsing
NUMBER SYNTAX ERROR	Number syntax error while parsing
LEARN ERROR	Error in machine setup string from "learn"
INVALID RANGE	Range error (e.g., FN code number, gate time, delay value)
LEVEL OR ATTN INVALID	Level out-of-range for the attenuator setting
Error 23	Phase measurement ratio out-of-range
24	Hardware ratio measurement produced divide by zero
25	Internal totalize error
26	Input buffer overflow
27	Gate did not open in specified time
28	Gate did not close in specified time
29	Frequency C not permitted on Model 1995
30	Error during calibration
31	Invalid syntax during calibration parsing or commands out-of-order
32	Cannot store calibration values to Non-Vol memory-values must be entered first
33	Error during calibration store to Non-Vol memory
40	Non-Vol Memory error-the Non-Vol data did not pass verification
41	Non-Vol Memory error during recall of memory
42	Non-Vol Memory-attemped recall of nonexistent machine setup store
50	Normalize function error (R-X)Y/Z
51	Statistical calculation error
60	Internal self-test: RAM
61	Internal self-test: ROM
62	Internal self-test: Non-Vol Memory
63	Internal self-test: measurement amplifier failure
64	Internal self-test: measurement logic failure

Table 4.25 - GPIB Error Messages and Codes (Cont'd)

Message/Code Number		Error
Error	70	Floating point addition error
	71	Floating point multiplication error
	72	Floating point division error
	73	Floating point compare error
	74	Floating point operation undefined
	75	Floating point underflow
	76	Floating point overflow
	78	ASCII to floating point conversion error
	79	Floating point to ASCII conversion error
	80	Double precision compare error
	81	Double precision to ASCII conversion error
	82	Double precision to floating point conversion error
	83	Integer divison by zero
	99	Internal software error

NOTE:

If an error is found in a command string, the entire string is ignored. No new programming of the counter will take place and the counter will continue taking measurements as previously set up.

SECTION 5 PERFORMANCE TESTS & CALIBRATION

5.1 PERFORMANCE TESTS

5.1.1 The performance tests in this section are used for receiving inspection/acceptance and periodic determination of the need for recalibration. Verify the basic operation of the counter before starting these tests by completing the rapid functional check found in Subsection 2.9.

5.1.2 Satisfactory completion of these performance tests will confirm the 1995/1996's operation by measurement function. Instrument covers need not be removed for any test. Complete the performance tests in the order given.

5.1.3 The following conditions must be maintained during these tests:

a. The counter must be operated from an AC supply

b. The line voltage must be within ± 10% of the indicated value of the line voltage selector

c. The ambient temperature must be 23°C ± 2°C

d. The power supply to the internal frequency standard must remain uninterrupted. (This does not apply if the counter is locked to an external frequency standard.)

5.1.4 Warm up the counter for one hour (switched to standby if necessary) before beginning these tests.

5.2 REQUIRED EQUIPMENT FOR PERFORMANCE TESTS

5.2.1 Table 5.1 lists the necessary test equipment for these performance tests. Equipment having operating characteristics equivalent to or better than those listed may be substituted. The procedures described in this section are general in nature and based on the use of the test equipment recommended. Some modification of the procedures may be required if substituted equipment is used.

Table 5.1 - Required Test Equipment

Item	Minimum Use Specifications	Quantity	Recommended Equipment
1. Signal Generator	10 kHz to 1.3 GHz amplitude 5 mV rms to 1V rms into 50 ohms	1	Racal-Dana Model 9087
2. Audio Generator	10 Hz to 10 kHz; amplitude of 25 mV rms into 50 ohms	1	Racal-Dana Model 845
3. AC Voltmeter (low frequency)	DC to 10 kHz; .1% resolution, and ± 2.5% accuracy	1	Racal-Dana Model 5002
4. Pulse Generator	1 Hz to 5 MHz, external lock and trigger capability; ± 1 ns jitter	1	Racal-Dana Model 1500
5. AC Voltmeter (high frequency)	10 kHz to 2 GHz; .1% resolution,and ± 2.6% accuracy to 500 MHz & ± 5% accuracy to 1.3 GHz	1	Racal-Dana Model 9300
6. BNC T-Connector	50 Ohms	1	—
7. Connector Lead	50-ohm coaxial cable with BNC connectors, ≈1m long	1	—
8. Coaxial Load	BNC connector, 50 ohms, 2W BNC ± 1%	1	—

5.3 PERFORMANCE TEST PROCEDURES

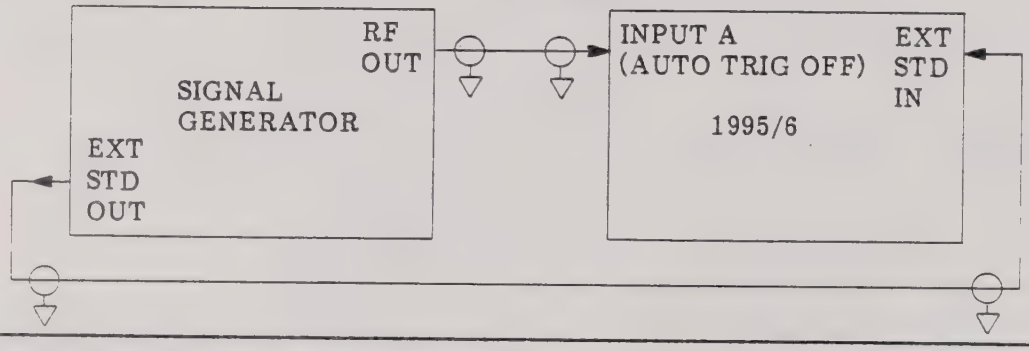
5.3.1 Power-on/self-test and home state conditions are described in Subsections 3.2.2 and 3.2.3, respectively. Refer to this information as necessary.

5.3.2 Set up the 1995/1996 and test equipment as shown in the following figures provided for each test procedure. Set the control and inputs as noted in each table and monitor the counter's readout for the indicated values.

Table 5.2 - Input A Sensitivity Performance Test, I

Applied Frequency : Performance Standard	Minimum Input Signal Level	Tolerance	Counter Resolution	Special Notes
200 MHz 100 MHz	50.0 mV rms 25.0 mV rms	± 2 digits ± 1 digit	9 digits * 9 digits * *1-sec gate	Use an AC voltmeter to verify applied input signal level into 50-Ω load before applying to UUT

Test Setup



Counter Input/Control Settings

1. Select FREQ A
2. Select 50 ohms impedance, Input A
3. Select AC coupling, Input A

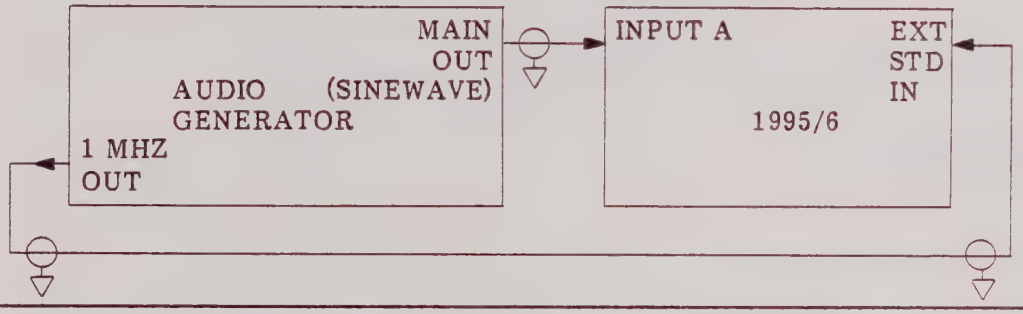
Procedures/Settings

1. Set up the counter and signal generator as shown above
2. At 200 MHz, set Input A's trigger level to 0.00 using key sequence〈0〉 TRIG-LEVEL A
3. At 100 MHz, press Input A's AUTO-TRIG key and verify that the AUTO-TRIG A's LED is lit
4. Apply inputs shown in table and verify that the 200 and 100 MHz measurements are within indicated tolerances

Table 5.3 - Input A Sensitivity Performance Test, II

Applied Frequency : Performance Standard	Minimum Input Signal Level	Tolerance	Counter Resolution	Special Notes
30 Hz 20 Hz	25 mV rms 25 mV rms	+ .1 Hz ± .1 Hz	1-ms gate 1-ms gate	Use an AC voltmeter to verify applied input signal level into 50-Ω load before applying to UUT

Test Setup

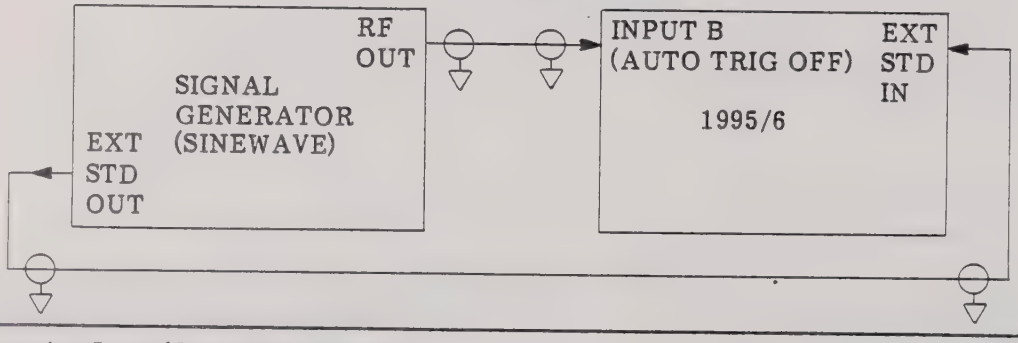


Counter Input/Control Settings	Procedures/Steps
1. Select FREQ A	1. Set up the counter and audio generator as shown above
2. Select AC coupling, Input A	2. At 30 Hz, press Input A's AUTO-TRIG key and verify that the AUTO-TRIG A's LED is lit
3. Select 50 ohms impedance, Input A	3. Verify that the 30 Hz measurement is within the indicated tolerance
4. Set Input A's AUTO-TRIG (30 Hz input)	4. Press the Input A's AUTO-TRIG key again; the AUTO-TRIG LED should go out
5. Set Input A's manual trigger level at 0.00 (20 Hz input)	5. At 20 Hz, set Input A's trigger level to 0.00 using key sequence <0> TRIG-LEVEL A
6. Set Gate Time of 1×10^{-3}s	6. Verify that the 20 Hz measurement is within the indicated tolerance

Table 5.4 - Input B Sensitivity Performance Test, I

Applied Frequency : Performance Standard	Minimum Input Signal Level	Tolerance	Counter Resolution	Special Notes
200 MHz 100 MHz	50.0 mV rms 25.0 mV rms	± 2 digits ± 1 digit	9 digits * 9 ditits *	Use an AC voltmeter to verify applied input signal level into 50-Ω load before applying to UUT
			*1-sec gate	

Test Setup



Counter Input/Control Settings

1. Select FREQ B using key sequence 21 SHIFT STORE SF SHIFT SF
2. Select 50 ohms impedance, Input B
3. Select AC coupling, Input B

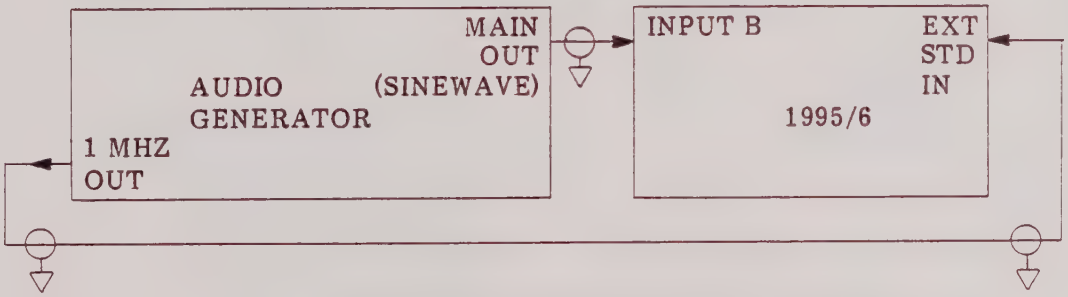
Procedures/Settings

1. Set up the counter and signal generator as shown above
2. At 200 MHz, set Input B's trigger level to 0.00 using key sequence <0> TRIG-LEVEL B
3. At 100 MHz, press Input B's AUTO-TRIG key and verify that the AUTO-TRIG B's LED is lit
4. Apply inputs shown in table and verify that the 200 and 100 MHz measurements are within indicated tolerances

Table 5.5 - Input B Sensitivity Performance Test, II

Applied Frequency : Performance Standard	Minimum Input Signal Level	Tolerance	Counter Resolution	Special Notes
30 Hz 20 Hz	25 mV rms 25 mV rms	± .1 Hz ± .1 Hz	1-ms gate 1-ms gate	Use an AC voltmeter to verify applied input signal level into 50-Ω load before applying to UUT

Test Setup



Counter Input/Control Settings

1. Select FREQ B using key sequence 21 SHIFT STORE SF SHIFT SF
2. Select AC coupling, Input B
3. Select 50 ohms impedance, Input B
4. Set Input B's AUTO-TRIG (30 Hz input)
5. Set Input B's manual trigger level at 0.00 (20 Hz input)
6. Set Gate Time of 1×10^{-3}S

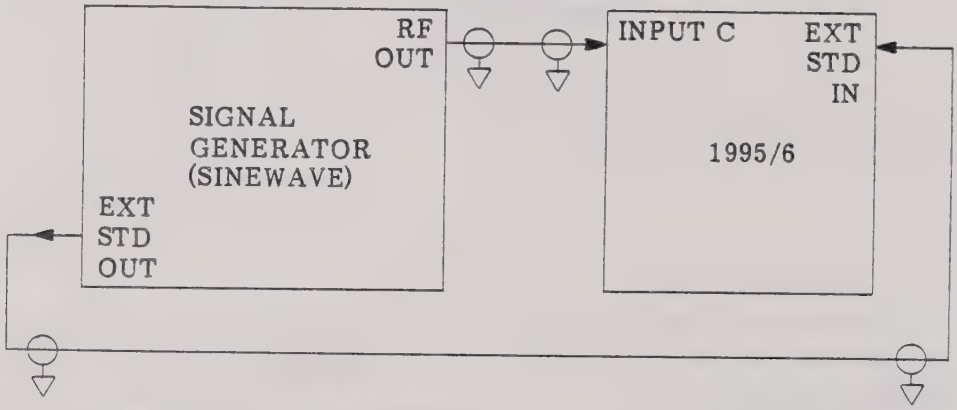
Procedures/Steps

1. Set up the counter and audio generator as shown above
2. At 30 Hz, press Input B's AUTO-TRIG key and verify that the AUTO-TRIG B's LED is lit
3. Verify that the 30 Hz measurement is within the indicated tolerance
4. Press the Input B's AUTO-TRIG key again; the AUTO-TRIG LED should go out
5. At 20 Hz, set Input B's trigger level to 0.00 using key sequence ⟨0⟩ TRIG-LEVEL A
6. Verify that the 20 Hz measurement is within the indicated tolerance

Table 5.6 - Input C Sensitivity Performance Test (1996)

Applied Frequency : Performance Standard	Minimum Input Signal Level	Tolerance	Counter Resolution	Special Notes
1.3 GHz 1.0 GHz 40 MHz	100 mV rms 10 mV rms 10 mV rms (7V max)	± 1 count ± 1 count ± 2 counts	9 digits* 9 digits* 8 digits**	Use an AC voltmeter to verify applied input signal level into 50-Ω load before applying to UUT
			* 1-sec gate **100 ms-gate	

Test Setup



Counter Input/Control Settings

1. Select FREQ C

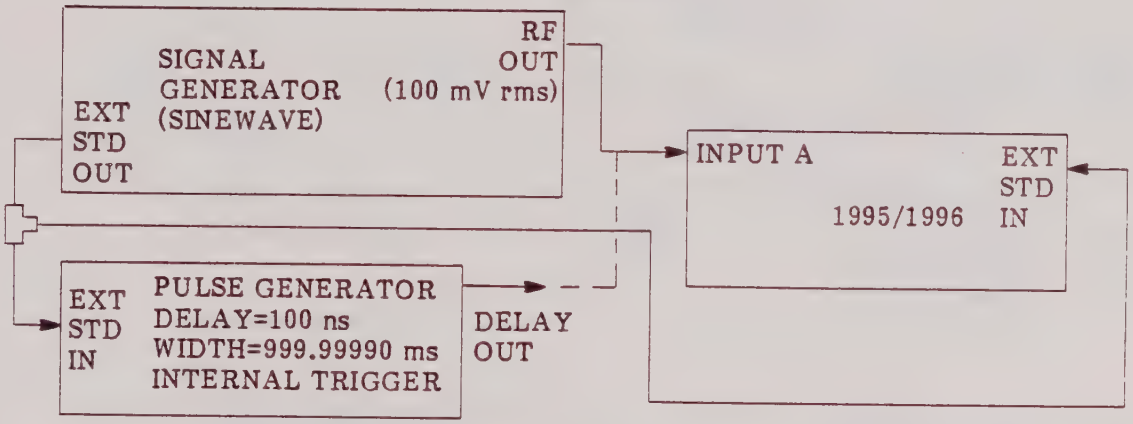
Procedures/Steps

1. Set up the counter and signal generator as shown above
2. Apply inputs shown in table and verify that the 1.3 GHz, 1.0 GHz, and 40 MHz measurements are within indicated tolerances

Table 5.7 - Period A Performance Test

Applied Frequency : Performance Standard	Minimum Input Signal Level	Tolerance	Counter Resolution	Special Notes
200 MHz/5 ns	100 mV rms	± 1 count	9 digits*	
1 Hz/1s	TTL into 50Ω	± 1 count	9 digits*	
			* 1-sec gate	

Test Setup



Counter Input/Control Settings

1. Select PERIOD A
2. Select 50 ohms impedance, Input A
3. Select DC coupling, Input A
4. Input A's AUTO-TRIG should be off and its LED out
5. Set Input A's manual trigger level at 0.00 (5 ns measurement)
6. Set Input A's manual trigger level at 1.30V (1 s measurement)

Procedures/Steps

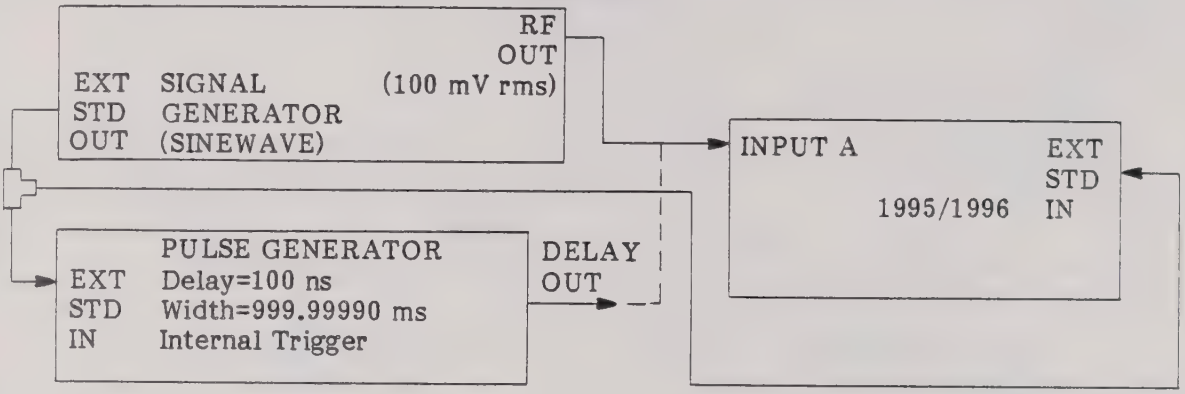
1. Set up the counter and signal generator as shown above - RF output of generator to Input A of counter
2. At 200 MHz, set Input A's trigger level to 0.00 using key sequence <0> TRIG-LEVEL A.

   Verify that LEVEL A of the counter displays 0.00
3. Verify the 5 ns measurement within the indicated tolerance
4. Connect the Delay Out of the pulse generator to Input A of the counter
5. At 1 Hz, set Input A's trigger level to 1.30V using key sequence <1.30> TRIG-LEVEL A. Verify that LEVEL A of the counter displays 1.30
6. Verify the 1s measurement within the indicated tolerance

Table 5.8 - Time Interval A→B Performance Test

Applied Frequency : Performance Standard	Required Input Signal	Tolerance	Special Notes
100 MHz/5 ns 1 Hz/1s	100 mV rms TTL into 50Ω	± 3 ns ± 3 ns	

Test Setup



Counter Input/Control Settings

1. Select T.I. A→B; COM A enabled
2. Select 50 ohms impedance, Inputs A and B
3. Select DC coupling, Input A
4. Input A's AUTO-TRIG should be off and it's LED out
5. Set Input A's trigger level at 0.00 (5 ns measurement)
6. Set Input A's trigger level at 1.30V (1s measurement)
7. Select Delay (1s measurement)

Procedures/Steps

1. Connect RF output of signal generator to Input A of counter
2. At 100 MHz, set Input A/B's trigger level to 0.00 using key sequence ⟨0⟩ TRIG-LEVEL A/B
3. Select slope ⌠ for Input A and slope ⌡ for Input B
4. Verify the 5 ns measurement within the indicated tolerance
5. Select slope ⌡ for Input A and slope ⌠ for Input B
6. Verify the 5 ns measurement within the indicated tolerance
7. Connect the Delay Out of the pulse generator to Input A of counter
8. At 1 Hz, set Input A/B's trigger level to 1.30V using key sequence ⟨1.3⟩ TRIG-LEVEL A/B

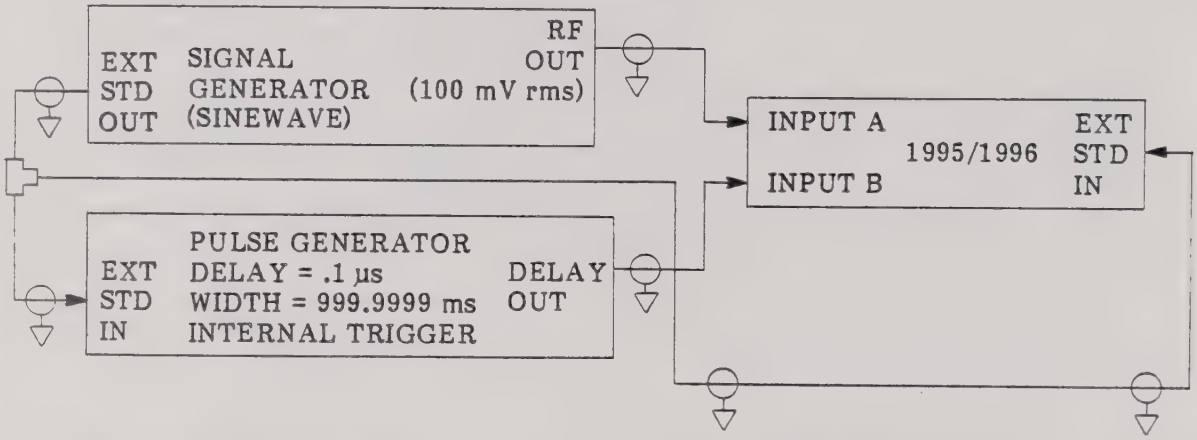
Table 5.8 - Time Interval A→B Performance Test (Cont'd)

Counter Input/Control Settings	Procedures/Steps
	9. Select DELAY on counter using key sequence SHIFT DELAY. Verify that the DELAY LED is lit
	10. Select slope ⌐, Inputs A and B
	11. Verify the 1s measurement within the indicated tolerance
	12. Press key sequence SHIFT DELAY. Verify that the counter's DELAY LED extinguishes

Table 5.9 - Total A by B Performance Test

Applied Frequency: A	B	Number of Counts	Tolerance	Special Notes
100 MHz	.99999999 Hz	99.999999×10^6	± 1 count	
20 kHz	10 kHz	2	± 1 count	

Test Setup



Counter Input/Control Settings

1. Select TOTAL A by B
2. Select 50 ohms impedance, Inputs A and B
3. Select DC coupling
4. Select Input A's AUTO-TRIG
5. Set Input B's trigger level at 1.30V using key sequence
   1.30 TRIG-LEVEL B

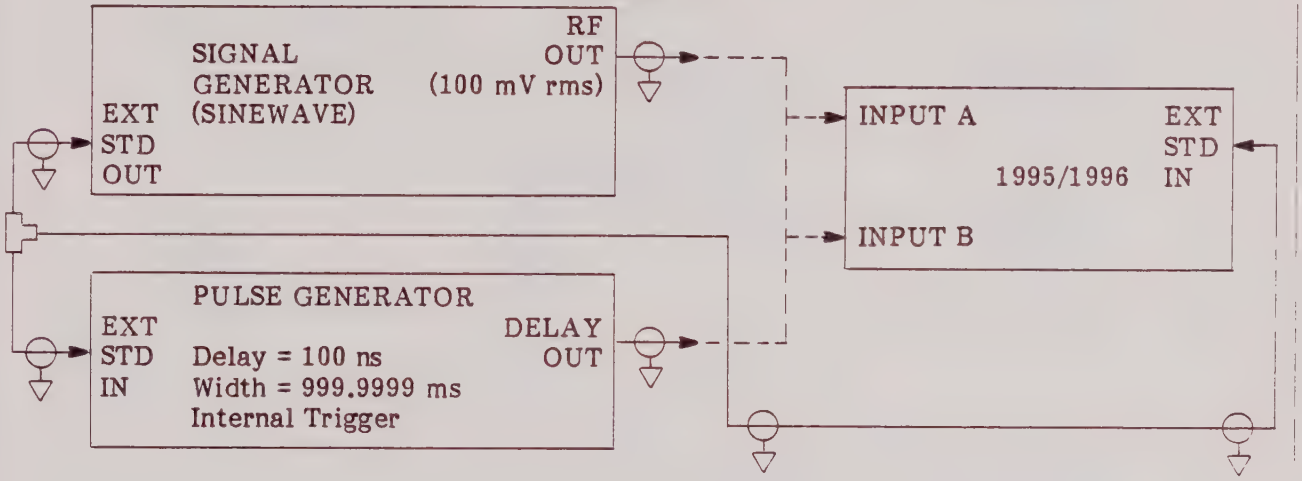
Procedures/Steps

1. Connect RF output of signal generator to Input A of counter for a 100 MHz output
2. Set up the pulse generator as shown above
3. Verify a 99.999999×10^6 count accuracy within the indicated tolerance
4. Set the signal generator to output 20 kHz
5. Set up the pulse generator as follows:
   Delay = 50 µs
   Width = 50 µs
6. Verify a 2 count accuracy within the indicated tolerance

Table 5.10 - Ratio A/B Performance Test

Applied Frequency: A	B	Performance Standard	Tolerance	Counter Resolution	Special Notes
200 MHz	1 Hz	200×10^6	± 1 count	9 digits *	
1 Hz	—	1.0	± 1 count	*1-sec gate	

Test Setup



Counter Input/Control Settings

1. Select RATIO A/B
2. Select 50 ohms impedance, Inputs A and B
3. Select DC coupling, Inputs A and B
4. Set Input B's trigger level at 1.30V using key sequence ⟨1.30V⟩ TRIG-LEVEL B
5. Set Input A's trigger level at 0.00 (200 MHz output) using key sequence ⟨0⟩ TRIG-LEVEL A
6. Set Input A's trigger level at 1.30V (1 Hz output) using key sequence ⟨1.30⟩ TRIG-LEVEL A

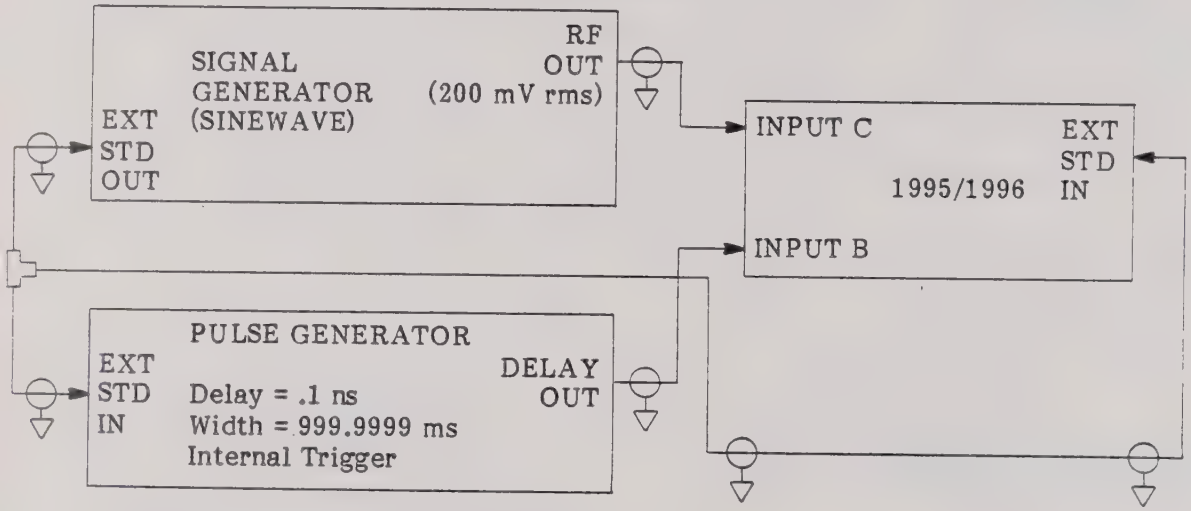
Procedures/Steps

1. Connect RF output of signal generator to Input A of counter for a 200 MHz output
2. Connect pulse generator to Input B of counter
3. Set Input A and B trigger levels as required for the output
4. Verify a 200×10^6 ratio accuracy within the indicated tolerance
5. Disconnect signal generator from Input A of counter
6. Connect pulse generator to Input A of counter
7. Select COM A on counter. Set Input A's trigger level as required
8. Verify a 1.0 ratio accuracy within the indicated tolerance

Table 5.11 - Ratio C/B Performance Test

Applied Frequency: C	D	Performance Standard	Tolerance	Counter Resolution	Special Notes
1.3 GHz	1 Hz	1.3×10^9	± 1 count	9 digits*	
40 MHz	1 Hz	4×10^8	± 1 count	9 digits*	
				*1-sec gate	

Test Setup



Counter Input/Control Settings

1. Select RATIO C/B
2. Select 50 ohms impedance, Input B
3. Select DC coupling, Input B
4. Set Input B's trigger level at 1.3V using key sequence ⟨1.3⟩ TRIG-LEVEL B

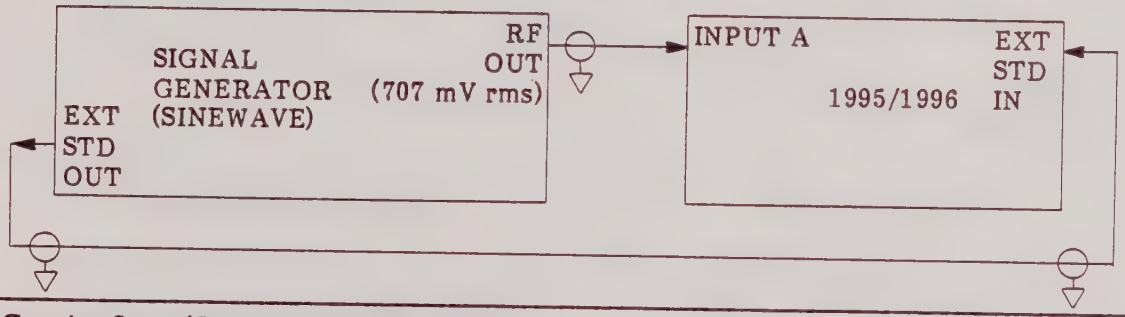
Procedures/Steps

1. Connect RF output of signal generator to Input C of the counter. Set the signal generator to output 1.3 GHz
2. Connect the pulse generator to Input B
3. Set Input B's trigger level at 1.3V
4. Verify a 1.3×10^9 ratio accuracy within the indicated tolerance
5. Set signal generator to output 40 MHz
6. Verify a 4×10^8 ratio accuracy within the indicated tolerance

Table 5.12 - Rise Time A Performance Test

Applied Frequency : Performance Standard	Tolerance		Special Notes
50 MHz/6.0 ns	± 3ns		Use an AC voltmeter to verify applied input signal level into 50-Ω load before applying to UUT

Test Setup



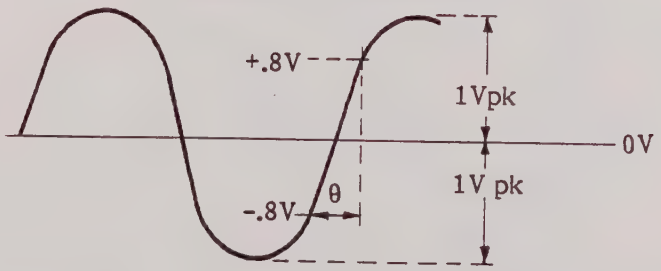
Counter Input/Control Settings

1. Select RISE A
2. Select 50 ohms impedance, Inputs A and B
3. Enable MEAN(n) = 100 using key sequence <100> SHIFT STORE (n) SHIFT MEAN. Verify that the MEAN LED lights

Procedures/Steps

1. Connect the RF output of signal generator to Input A of the counter. Set the signal generator to output 50 MHz
2. Verify a 6.0 ns reading within the indicated tolerance

Rise Time A Waveform

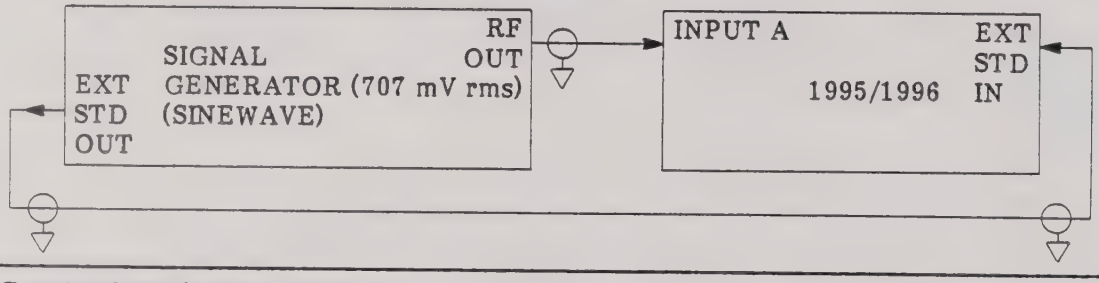


$$\text{Rise Time} = \frac{.3}{50 \times 10^6} = 6 \text{ ns}$$

Table 5.13 – Fall Time A Performance Test

Applied Frequency : Performance Standard	Tolerance		Special Notes
50 MHz/6.0 ns	± 3 ns		Use an AC voltmeter to verify applied input signal level into 50-Ω load before applying to UUT

Test Setup



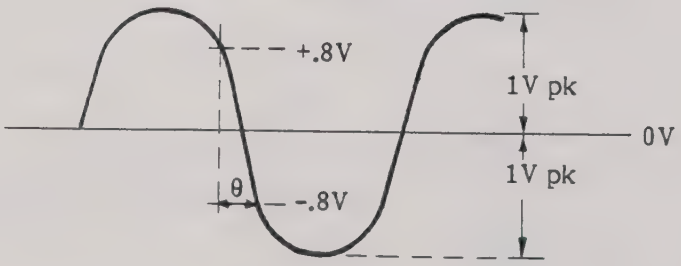
Counter Input/Control Settings

1. Select FALL A
2. Select 50 ohms impedance, Inputs A and B
3. Enable MEAN(n) = 100 using key sequence <100> SHIFT STORE (n) SHIFT MEAN. Verify that the MEAN LED lights

Procedures/Steps

1. Connect the RF output of signal generator to Input A of the counter. Set the signal generator to output 50 MHz
2. Verify a 6.0 ns reading within the indicated tolerance

Rise Time A Waveform

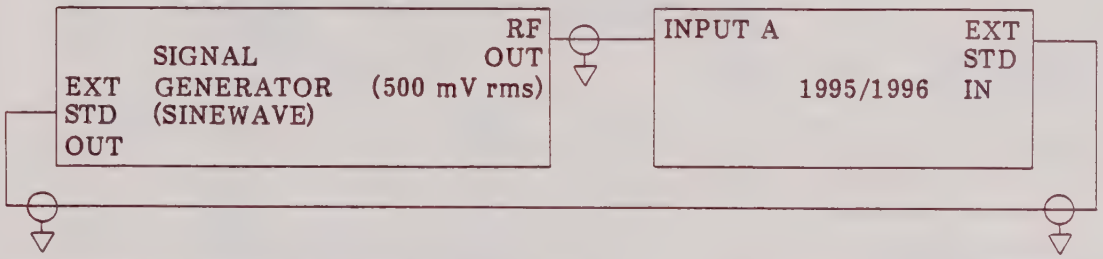


$$\text{Rise Time} = \frac{.3}{50 \times 10^6} = 6.0 \text{ ns}$$

Table 5.14 - Positive Pulse Width Performance Test

Applied Frequency : Performance Standard	Tolerance		Special Notes
100 MHz/5 ns	± 3 ns		

Test Setup



Counter Input/Control Settings

1. Select POS WIDTH A
2. Select 50 ohms impedance, Inputs A and B

Procedures/Steps

1. Connect the RF output of signal generator to Input A of the counter. Set the signal generator to output 100 MHz
2. Verify a 5 ns reading within the indicated tolerance

Positive Pulse Width Waveform

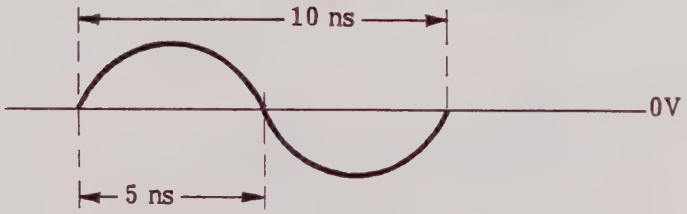
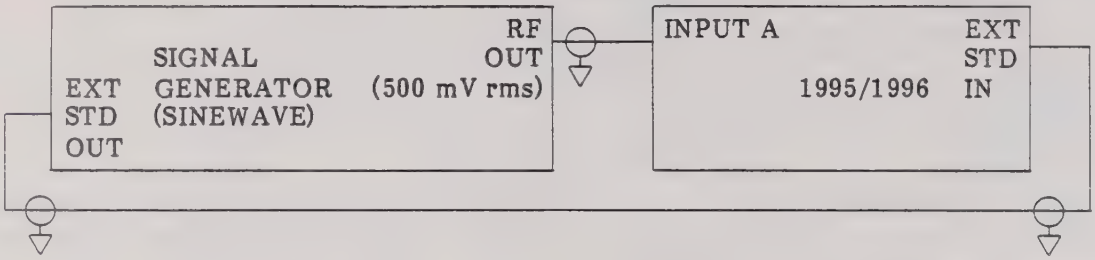


Table 5.15 - Negative Pulse Width Performance Test

Applied Frequency : Performance Standard	Tolerance		Special Notes
100 MHz/5 ns	± 3 ns		

Test Setup



Counter Input/Control Settings

1. Select NEG WIDTH A
2. Select 50 ohms impedance, Inputs A and B

Procedures/Steps

1. Connect the RF output of signal generator to Input A of the counter. Set the signal generator to output 100 MHz
2. Verify a 5 ns reading within the indicated tolerance

Negative Pulse Width Waveform

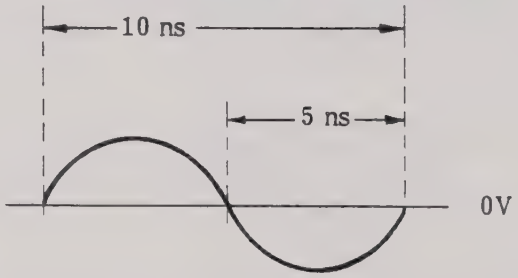
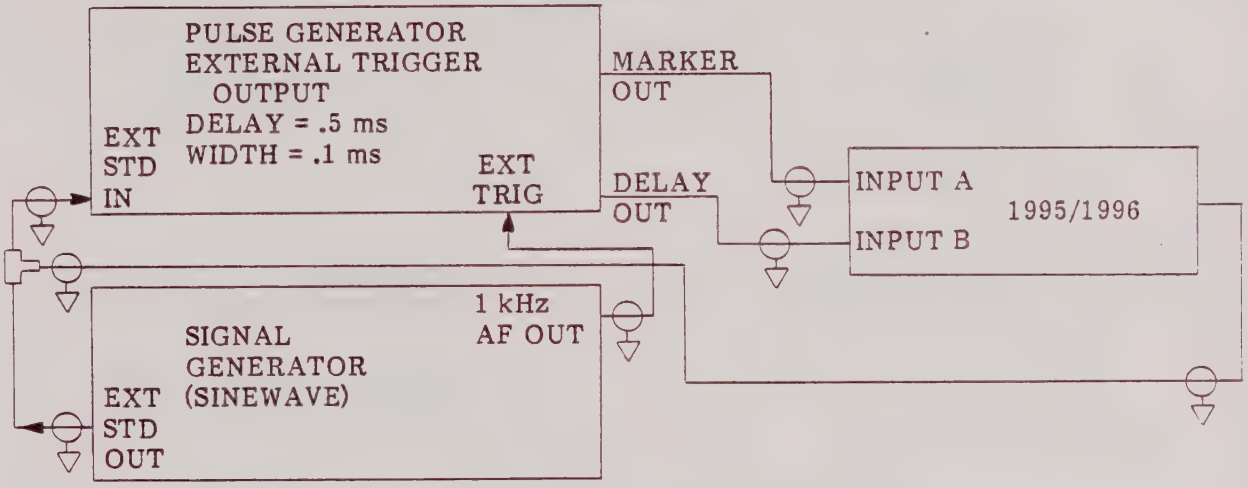


Table 5.16 - Phase A rel B Performance Test

Applied Frequency :	Performance Standard	Tolerance	Counter Resolution	Special Notes
1 kHz	180°	± .1°	9 digits* *1-sec gate	

Test Setup



Counter Input/Control Settings

1. Select PHASE A rel B
2. Select 50 ohms impedance, Inputs A and B

Procedures/Steps

1. Set up counter, signal generator, and pulse generator as shown above
2. Verify a 180° reading within the indicated tolerance

Phase A rel B Waveform

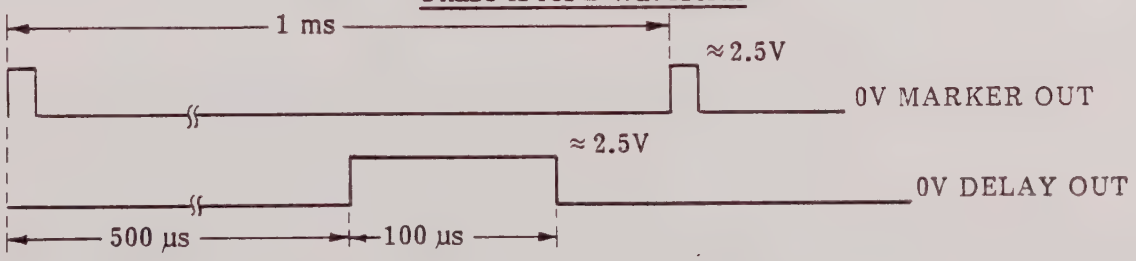
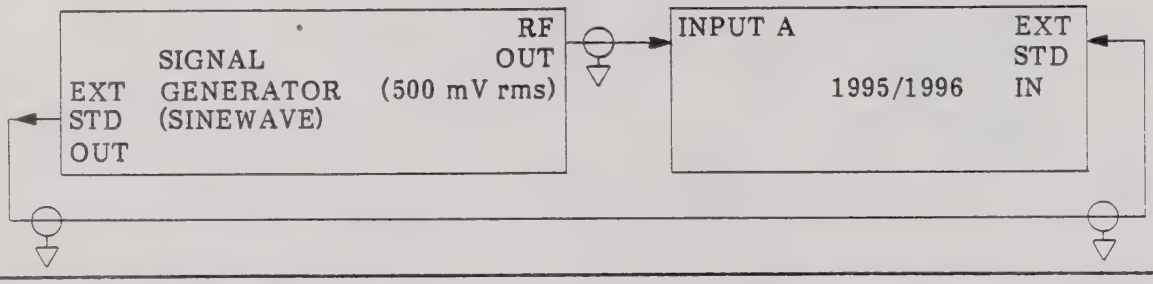


Table 5.17 - Duty Cycle A Performance Test

Applied Frequency :	Performance Standard	Tolerance	Counter Resolution	Special Notes
10 MHz	50%	± .04%	9 digits* *1-sec gate	

Test Setup



Counter Input/Control Settings

1. Select DUTY A
2. Select 50 ohms impedance, Inputs A and B

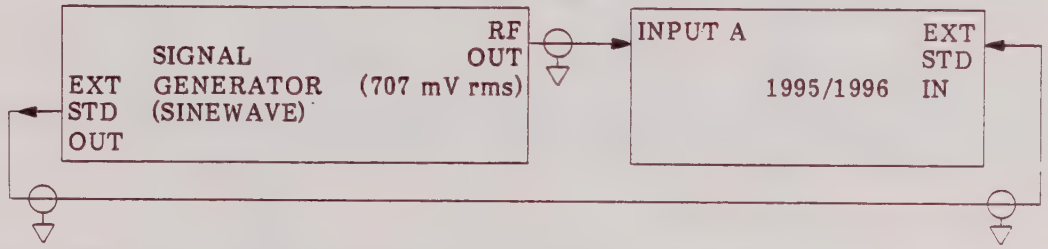
Procedures/Steps

1. Connect the RF output of signal generator to Input A of the counter. Set the signal generator to output 10 MHz
2. Verify a 50% reading within the indicated tolerance

Table 5.17 - Slew Rate A Performance Test

Applied Frequency : Performance Standard	Tolerance	Counter Resolution	Special Notes
5 MHz/29 x 10^6V/s	± 6 x 10^6V/s	9 digits* *1-sec gate	Use an AC voltmeter to verify applied input signal level into 50-Ω load before applying to UUT

Test Setup



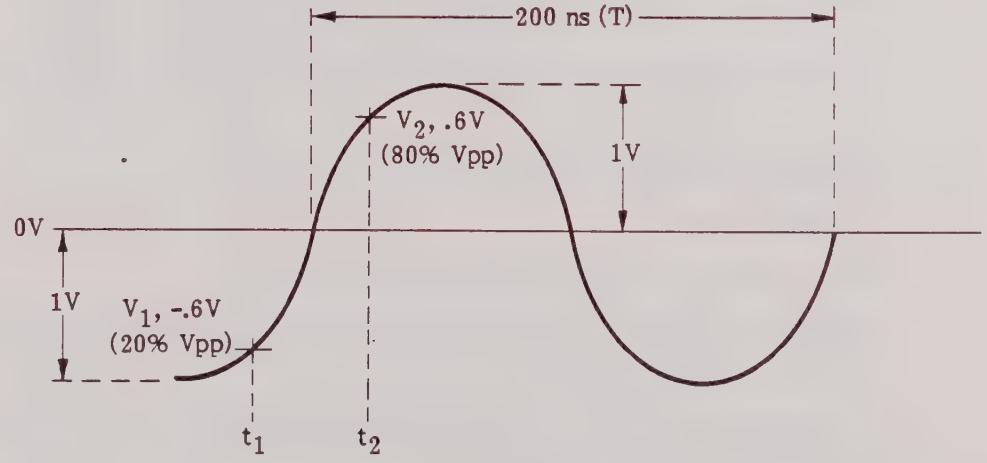
Counter Input/Control Settings

1. Select SLEW A
2. Select 50 ohms impedance, Inputs A

Procedures/Steps

1. Connect the RF output of signal generator to Input A of the counter. Set the signal generator to output 5 MHz
2. Verify a 29 x 10^6V/s reading within the indicated tolerance

Slew Rate A Waveform



$$\text{Slew Rate} = \left(\frac{V_2 - V_1}{t_2 - t_1}\right) = \frac{1.2V}{40.96 \times 10^{-9}\ \text{sec}} \simeq \frac{29.3 \times 10^6 V}{\text{Sec}}$$

$$V_2 - V_1 = .6 - (-.6) = 1.2V$$

$$t_2 - t_1 = \frac{2\,(\text{SIN}^{-1} \times .6)}{360} \times T = \frac{73.74^{\circ}}{360^{\circ}} \times 200\ \text{ns} = 40.96\ \text{ns}$$

5.4 CALIBRATION

5.4.1 This procedure provides calibration information for Racal-Dana's Universal Systems Counters Models 1995/1996.

5.5 REQUIRED EQUIPMENT FOR CALIBRATION

a. Digital voltmeter with at least a 1 mV accuracy in the 10V range. Use a Racal-Dana Model 5004 or its equivalent

b. GPIB controller. Use a Hewlett-Packard Model 9826 or its equivalent

c. DC source with a single-pole output filter set for a 3-dB cutoff frequency of 1.6 Hz (1 KΩ resistor and 100 μF capacitor)

5.6 CALIBRATION PROCEDURE

a. Turn unit-under-test (UUT) on. Allow 15 minutes for thermal stabilization of the counter

b. Sent the following string to the counter:

"CAL" <cr lf>

c. Send the following string to the counter:

"CLHI" <cr lf>

d. Connect the voltmeter to the Start DAC (START-CAL LEVEL) output on the rear panel of the UUT and record this voltage (Vstart-high)

e. Connect the voltmeter to the Stop DAC (STOP-CAL LEVEL) output on the rear panel of the UUT and record this voltage (Vstop-high)

f. Send the following string to the counter:

"CLLO" <cr lf>

The counter now enters the calibration routine

g. Record the voltage reading of the meter at the Stop DAC (STOP-CAL LEVEL) output of the UUT (Vstop-low)

h. Connect the voltmeter to the Start DAC (START-CAL LEVEL) output of the UUT and record this voltage (Vstart-low)

i. Send the following command strings to the counter:

"CLTH" <cr lf> - Vstart-high
"CLPH" <cr lf> - Vstop-high
"CLTL" <cr lf> - Vstart-low
"CLPL" <cr lf> - Vstop-low

where Vstart-high, Vstop-high, Vstart-low, and Vstop-low are the previously recorded values. At this point "CAL" is shown on the main display

j. About 5 minutes later, when calibration is completed, "CAL donE" is displayed on the front panel. Values can now be stored to non-vol memory. Depress the calibration switch (through the front-panel opening to the right of the POWER button), while sending the following string to the counter:

"CLST" <cr lf>

k. Keep the calibration switch depressed until the main display shows "donE" indicating successful non-vol memory store

l. A <space cr lf> GPIB output is given, and the calibration switch can now be released

m. If at any point an error is generated (e.g., syntax, calibration), the entire procedure must be repeated

5.7 VERIFICATION PROCEDURE

a. Connect the DC source to Inputs A and B of the UUT. Adjust the DC voltage to 4.50V using the voltmeter

b. Press the RESET key on the front panel, then the AUTO-TRIG keys for both Inputs A and B

c. Verify that the trigger LEVEL A and B displays show trigger levels between 4.45 and 4.55 volts

d. Adjust the DC source to -4.50V using the voltmeter

e. Verify that the trigger LEVEL A and B displays show trigger levels between -4.45 and -4.55 volts

5.8 INTERNAL REFERENCE ADJUSTMENT

5.8.1 There are two internal reference oscillators available for the 1990 Series Universal Systems Counter.

5.8.2 The calibration procedure for the standard oscillator is a single variable capacitor adjustment, accessible at OSC ADJ on the rear panel. The option has two adjustments (COARSE and FINE), accessible at the rear panel.

5.8.3 Reference Oscillator Frequency Check

a. Select the following control settings:
(home state at power-up)

FUNCTION	FREQ A
GATE TIME	1 second
INPUT A	
SLOPE	⎍
COUPLING	DC
TRIGGER LEVEL	AUTO

b. Connect the 1 MHz frequency standard to Input A

c. The difference between the internal reference oscillator and the 1 MHz frequency standard can be determined by the following equation:

Internal oscillator frequency = (2E6-display) x 10

d. Some examples of various counter readings and the frequency difference that is indicated are shown below:

Counter Display	Internal Reference Oscillator
9.999995000 E3	10,000.05000 kHz
10.000000000 E6	10,000.00000 kHz
10.000002500 E6	9,999.97500 kHz

5.8.4 Adjustment Procedure

a. Connect the 1 MHz frequency standard to the vertical input of the oscilloscope, and connect the OUT REF signal from the rear panel of the counter to the external trigger of the oscilloscope (see wiring diagram below)

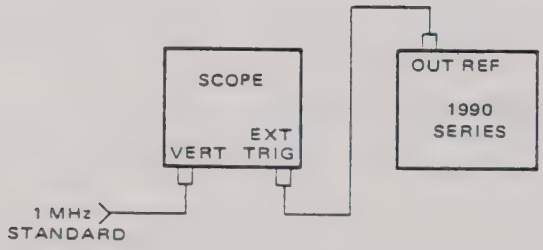


Figure 5.1 - Internal Reference Adjustment Procedure

b. Set the oscilloscope controls as follows:

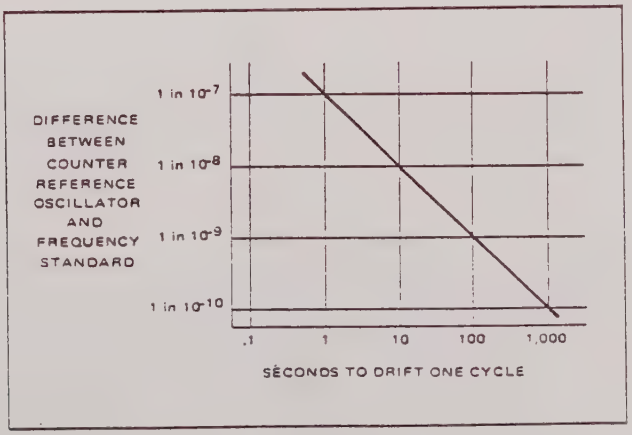
TRIGGER	
SLOPE:	⎍
COUPLING:	AC
SOURCE:	EXT
SWEEP MODE	
NORM TRIGGER	
SWEEP:	.05 μs
CHANNEL	
INPUT:	AC
volts/div	Depends on amplitude of frequency standard
TRIGGER	
LEVEL:	Center of mechanical span

c. Adjust the trigger level for an oscilloscope display of the frequency standard output

d. If the counter is equipped with the standard reference oscillator, adjust OSC ADJ on the rear panel for an oscilloscope display that is as stationary as possible (i.e., does not drift to the left or right)

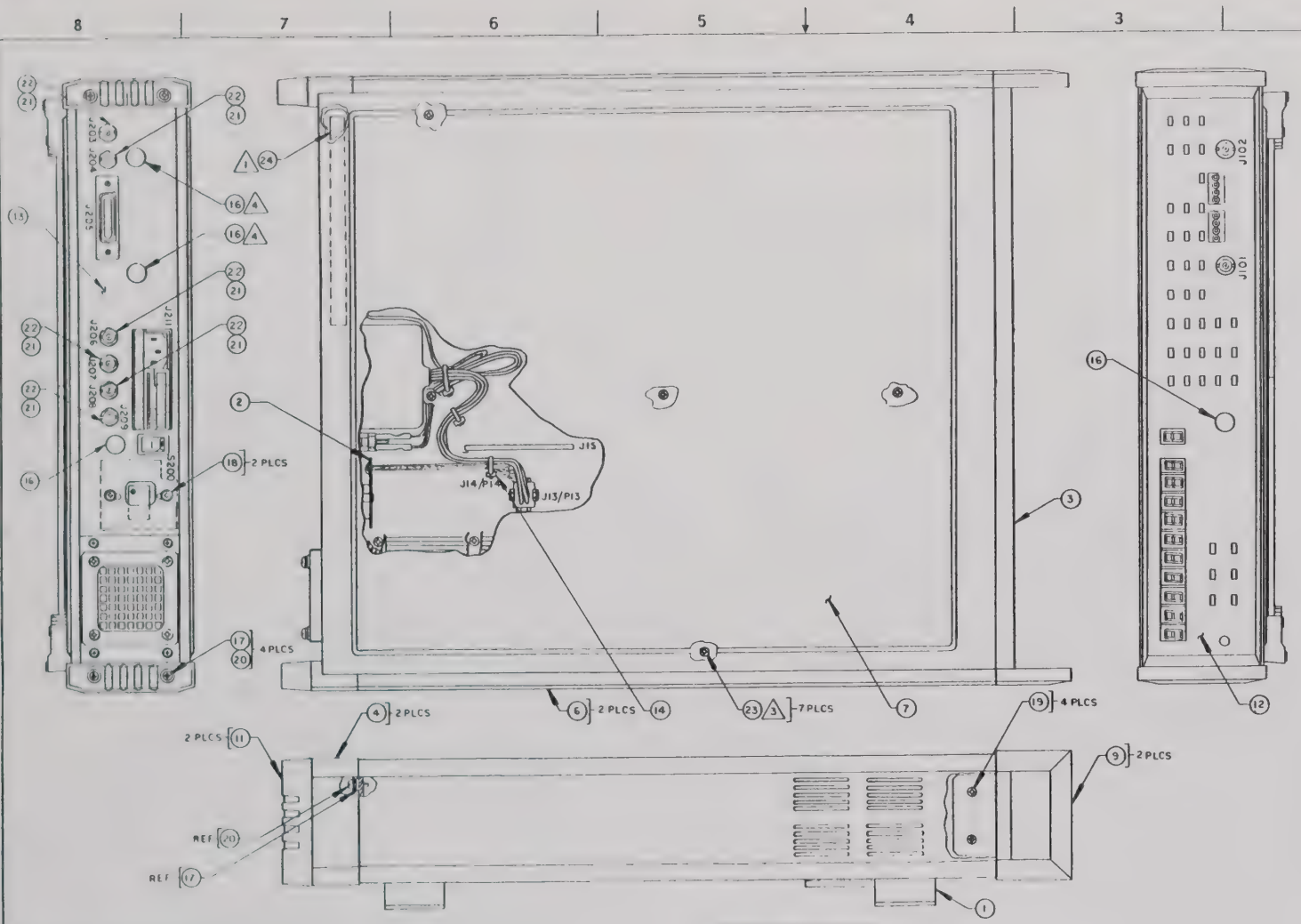
e. If the instrument is equipped with an optional high-stability reference oscillator, use the COARSE and FINE adjustment controls to perform step d

f. To determine the drift rate of the calibrated instrument, measure the time it takes the oscilloscope pattern to drift 5 divisions on the oscilloscope. The oscillator drift can be determined from the figure shown below



SECTION 6 DRAWINGS

404335	Counter Assembly (1995)	6-2
404336	Counter Assembly (1996)	6-3
404332	Chassis Assembly	6-4
401730	PCB Assy., 10 MHz Oscillator	6-6
431730	Schematic, 10 MHz Oscillator	6-7
19-1142	PCB Assy., Channel C (1996)	6-8
432152	Schematic, Channel C (1996)	6-9
——	Component Location, Motherboard	6-10
401725	PCB Assy., Motherboard	6-12
431725	Schematic, Motherboard	6-13
401726	PCB Assy., Signal Conditioner	6-25
431726	Schematic, Signal Conditioner	6-27
401728	PCB Assy., AMCC2 Synch	6-33
431728	Schematic, AMCC2 Synch	6-35
401727	PCB Assy., Display	6-36
431727	Schematic, Display	6-37
404331	Assy., Rear Panel	6-39
404378	Assy., Rear Input, Option 01	6-40
401752	PCB Assy., Option 01	6-41
404384	Assy., Option 04E	6-42
404386	Oscillator (Option 04E)	6-43
404387	Assy., 220/240V Operation (Option 71)	6-44
454847	Dimensional Outline	6-45



4 PLASTIC HOLE PLUGS ITEM "16 SHOULD BE MOVED TO RELATING HOLES IN FRONT PANEL WHEN CHANNEL A & B REAR INPUT IS INSTALLED.

3 INSTALL SCREWS (ITEM "23) IN MOTHERBOARD PRIOR TO INSTALLING COVERS.

2 ITEMS 15 & 25 TO BE SHIPPED WITH INSTRUMENT.

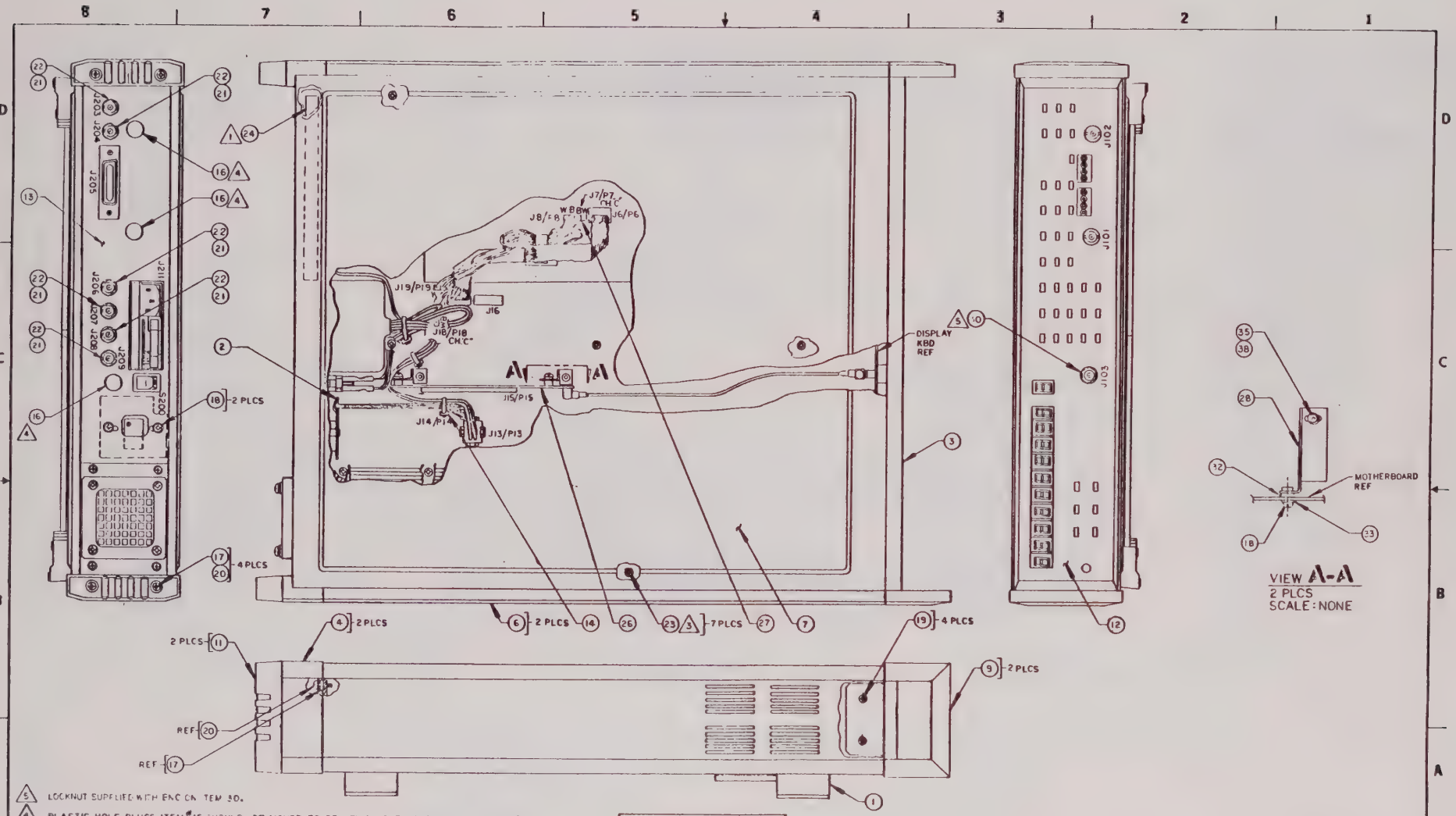
1 TYPE PERTINENT DATA ON SERIAL NO. TAG., ATTACH TAG APPROXIMATELY WHERE SHOWN.

PROPRIETARY NOTICE

THIS DRAWING OR AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DATA IN STREAM DESIGN AND SHALL NOT WITHOUT EITHER WRITTEN PERMISSION OR RACAL DATA INSTRUMENTS MEET THE REQUIRED CONDITIONS USED IN WHOLE OR IN PART AS AN AID TO OBTAIN SOLICITATION OR THE ALL INCLUSIVE SOURCE OR USED FOR MANUFACTURING OR ANYONE OTHER THAN RACAL DATA INSTRUMENTS OR THE RECIPIENTS NAMED IN THE AGREEMENT BETWEEN THE PARTIES AND MAY NOT BE DISCLOSED OR DISTRIBUTED TO ANY OTHER PERSON OR ENTITY WITHOUT THE PRIOR WRITTEN CONSENT OF RACAL DATA INSTRUMENTS.

DOCUMENT TITLE			
COUNTER ASSY, UN. SYS. MODEL 1995			
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	404335	B
SCALE 3/4		SHEET 1 OF 2	

404335



5 LOCKNUT SUPPLIED WITH ENC ON ITEM 30.

4 PLASTIC HOLE PLUGS ITEM #16 SHOULD BE MOVED TO RELATING HOLES IN FRONT PANEL WHEN CHANNEL A, B & C REAR INPUT IS INSTALLED.

3 INSTALL SCREWS (ITEM #23) IN MOTHERBOARD PRIOR TO INSTALLING COVERS.

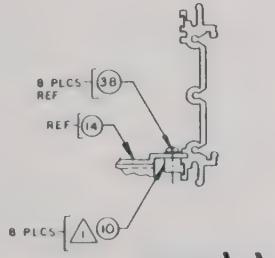
2 ITEMS 15 & 25 TO BE SHIPPED WITH INSTRUMENT.

1 TYPE PERTINENT DATA ON SERIAL NO. TAG., ATTACH TAG APPROXIMATELY WHERE SHOWN.

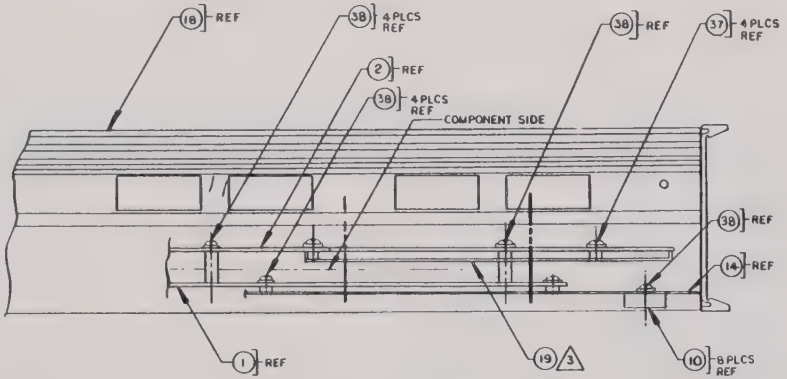
PROPRIETARY NOTICE
THIS DOCUMENT AND THE INFORMATION HEREON DISCLOSED ARE PROPRIETARY TO RACAL DATA IN STATEMENT INC. AN SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DATA INSTRUMENTS INC. BE USED, RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DATA INSTRUMENTS INC. THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INFORMATION PERTAINING TO SALES RELATIONS AND OTHER DOCUMENTS WITHOUT PRIOR WRITTEN CONSENT OF RACAL DATA INSTRUMENTS INC.

DOCUMENT TITLE			
COUNTER ASSY, UN. SYS. MODEL 1996			
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	404336	B
SCALE 3/4		SHEET 1 OF 3	

DOC NO 404336



SECTION A-A
SCALE : NONE



SECTION B-B
SCALE : NONE

(3) SHIELD, ITEM NO. 19 MUST BE ATTACHED TO PCB ASSY ITEM NO. 2 PRIOR TO INSTALLING IN CHASSIS.

(2) RETAINING NUTS SUPPLIED WITH BNC'S ON ITEM NO. 2

(1) INSTALL & ORIENT ITEM NO. 10 AS SHOWN.

NOTE: UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC. AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC. BE USED, RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC.

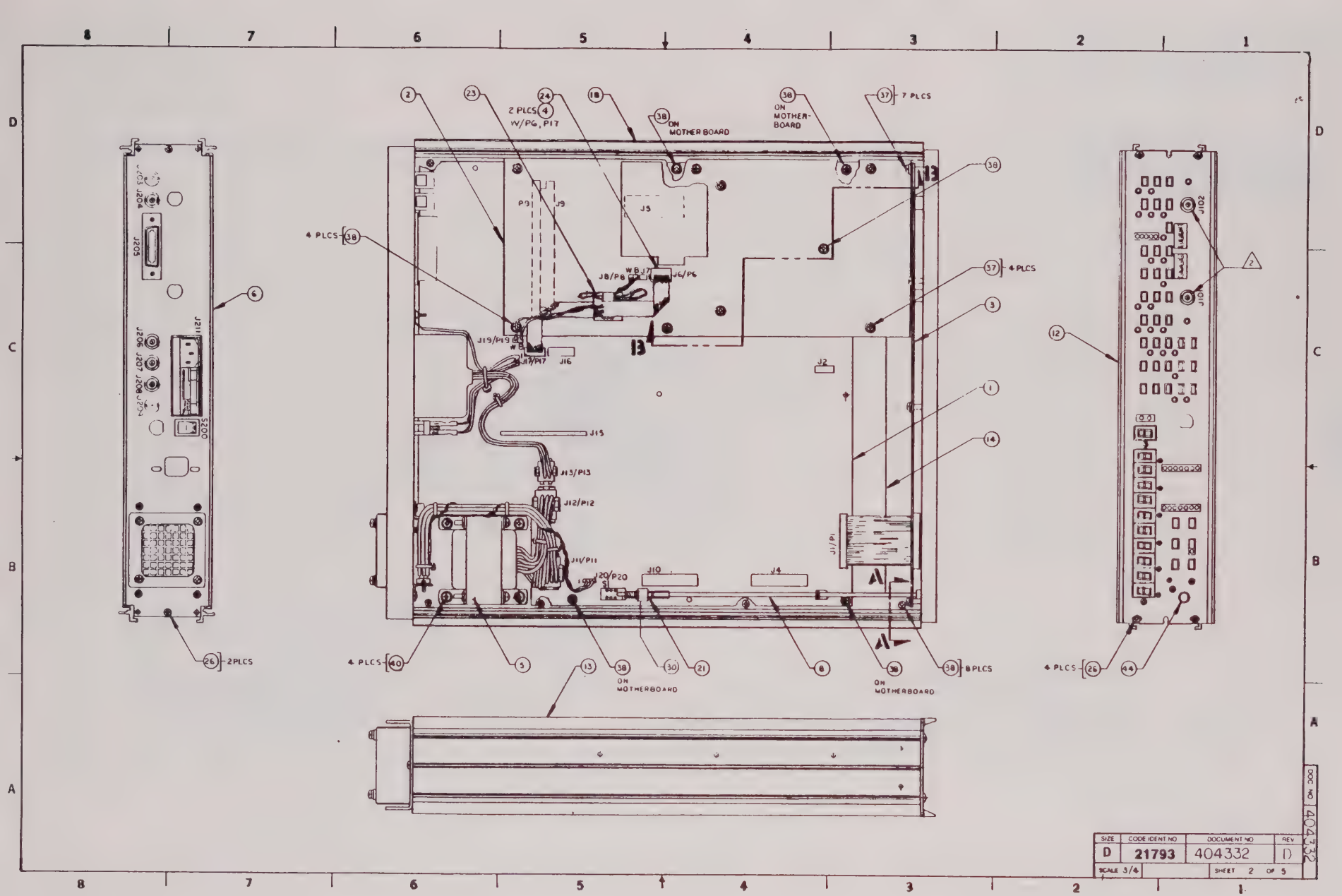
RACAL-DANA Instruments Inc.
4 GOODYEAR, IRVINE CALIFORNIA 92714

DOCUMENT TITLE: CHASSIS ASSY

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	404332	D

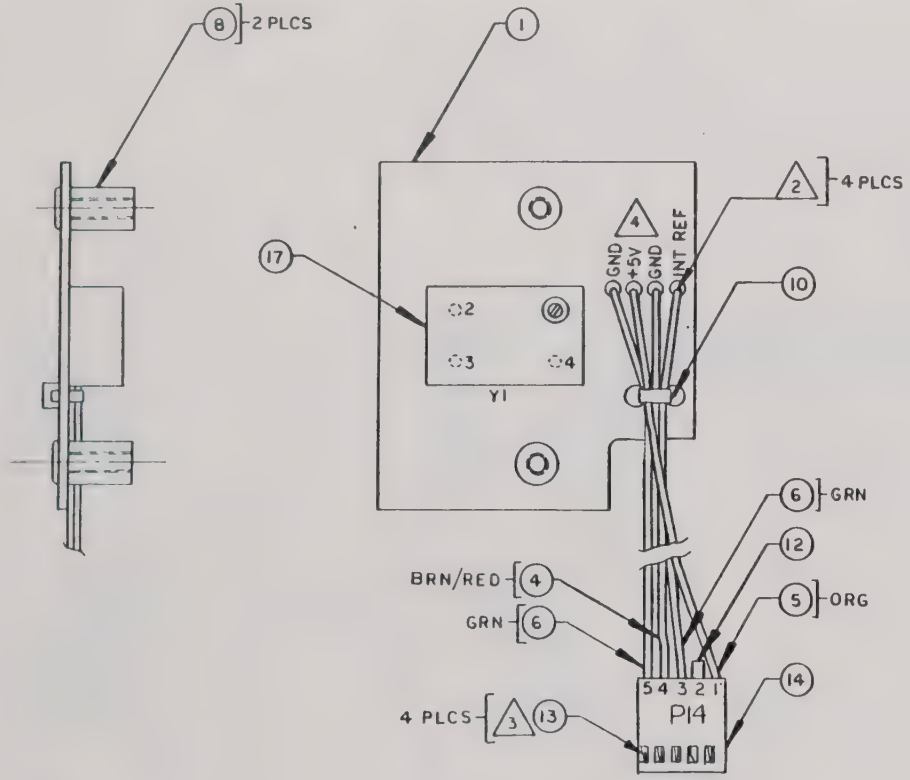
SCALE 3/4 SHEET 1 OF 5

404332



SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	404332	D
SCALE 3/4		SHEET 2 OF 5	

DOC NO 404332



4 NOMENCLATURE SHOWN IS ON FARSIDE OF PC BOARD.

3 STRIP WIRE .14.

2 STRIP WIRE .25.

1. SCHEMATIC REF NO. 431730

NOTES: UNLESS OTHERWISE SPECIFIED

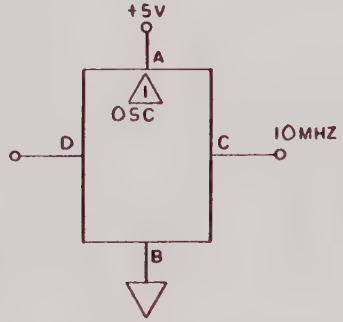
PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREIN DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC. AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION, BE RACAL DANA INSTRUMENTS INC. BE USED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM ANY COMPETITIVE SOURCE. BY ACCEPTANCE OF THIS DOCUMENT BY ANY ONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREIN SHALL BE HELD IN CONFIDENCE AND USED ONLY FOR THE PURPOSE FOR WHICH IT WAS DEVELOPED AT PRIVATE EXPENSE AND MAY NOT BE USED, DISCLOSED OR REPRODUCED FOR ANY OTHER PURPOSE EXCEPT AS EXPRESSLY AUTHORIZED IN WRITING BY RACAL DANA INSTRUMENTS INC. (ALL RIGHTS RESERVED UNDER COPYRIGHT LAWS.)

PCB ASSY, 10MHZ OSC.

SIZE	DOCUMENT NO	REV
C	21793	401730	A

SCALE 2:1 SHEET 1 OF 3

DOC. NO 401730



OSC. VENDOR CHART

	P/N 921013 NDK	P/N 921014 TCXO	P/N 921013 SEI
A	4	2	2
B	2	4	1
C	3	1	3
D	1 (NC)	3 (NC)	4 (NC)

1 FOR SPECIFIC PIN NUMBERS REFER TO OSC. VENDOR CHART.

NOTES: UNLESS OTHERWISE SPECIFIED

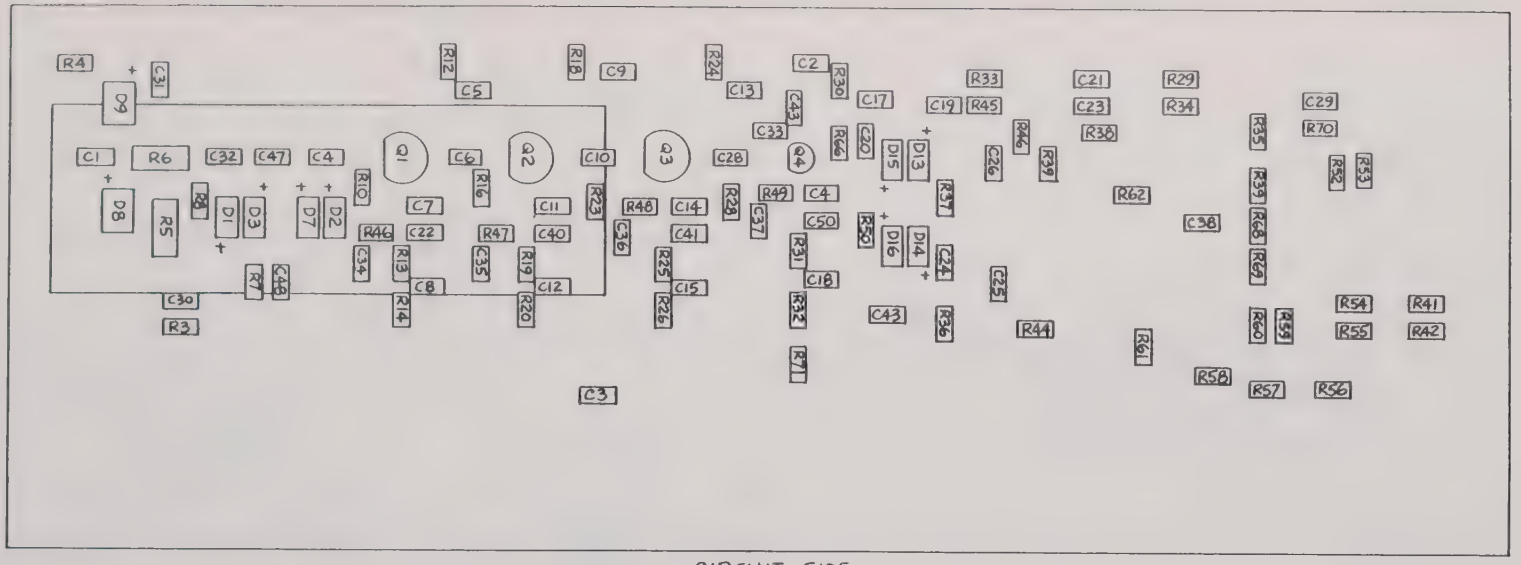
PROPRIETARY NOTICE

THIS DOCUMENT AND THE TECHNICAL DATA HERE ON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EX PRESS WRITTEN PERMISSION OF RACAL DANA IN STRUMENTS INC BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTA TIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC THE INFORMATION HERE ON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGI NEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOC UMENTS WHICH SPECIFY PROCUREMENT OF PRO DUCTS FROM RACAL DANA INSTRUMENTS INC

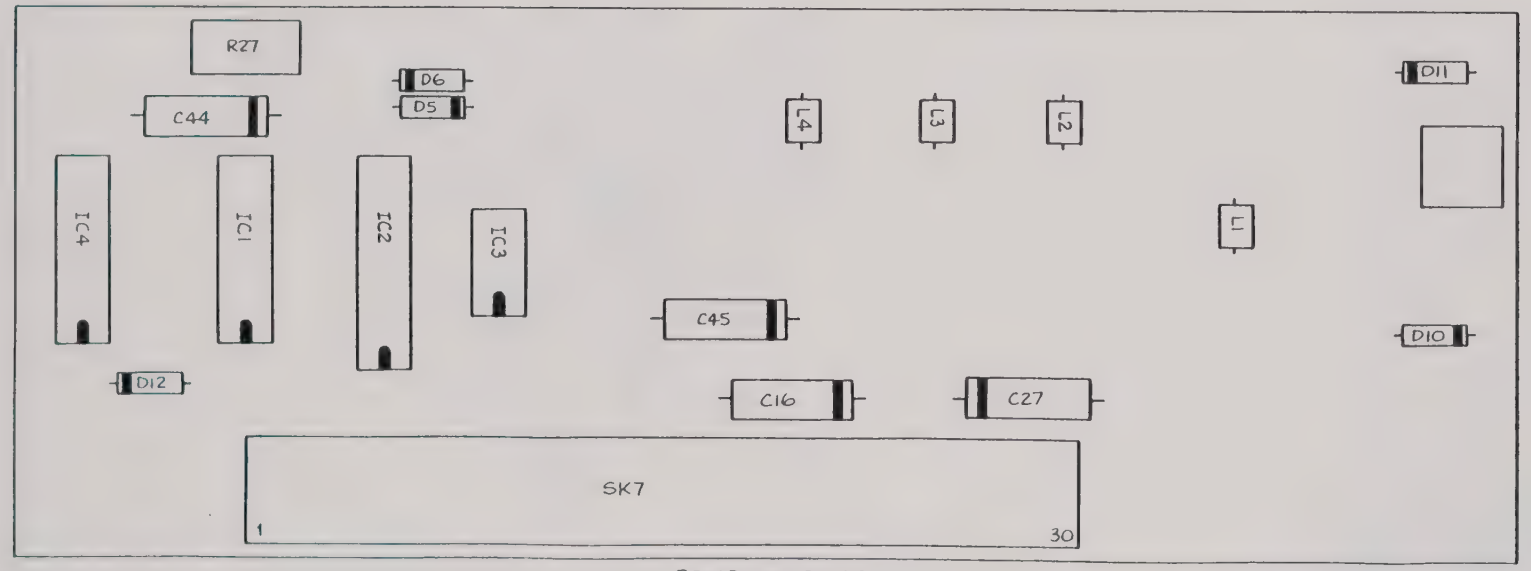
SCHEMATIC, 10MHZ OSC

SIZE	CODE IDENT NO	DWG NO.	REV
B	21793	431730	A

SCALE —— SHEET 1 OF 1

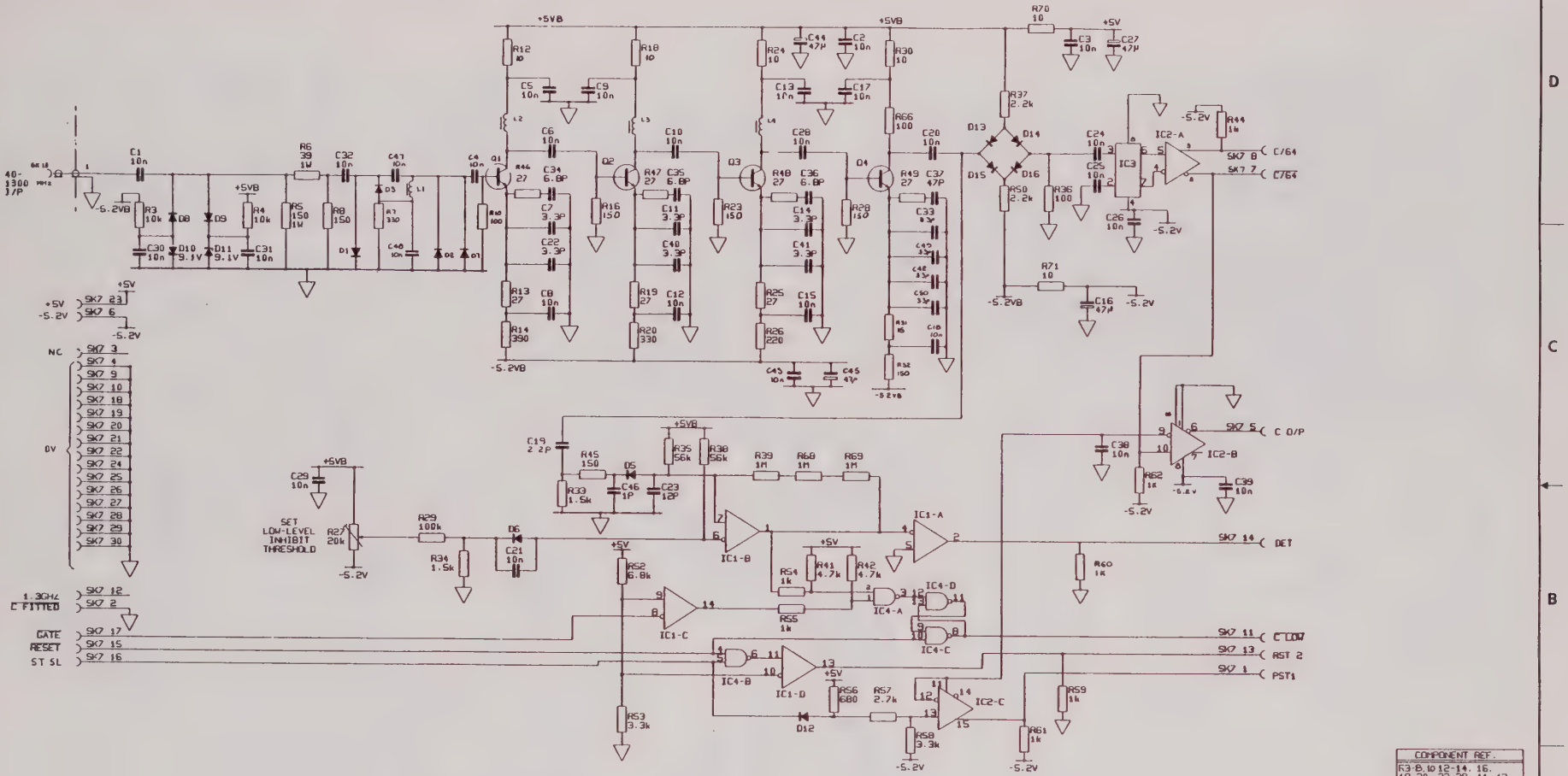


CIRCUIT SIDE



COMPONENT SIDE

RACAL-DANA Instruments Inc. IRVINE CALIFORNIA			
PCB ASSY., CHANNEL C			
SIZE	CODE IDENT NO. 21793	DWG NO. 19-1142	REV 2
SCALE		SHEET 1 OF 2	



REFERENCE	TYPE NO.	PART NO.	+5V	0V	-5.2V
D12	1N4149	22-1029			
D2-7	5082-3379	22-1058			
D8 9	5082-2800	22-1060			
D13 5,6 15-16	5082 2835	22-1086			
D10.11	BZX79C9V1	22-1014			
IC1	LM339	22-4249	3		12
IC2	AD1116	22-4528		1,16	8
IC3	74LS00	22-4531	14	7	
IC4	SP4632	22-4687		8	4
Q1-3	BFR96	22-6123			
Q4	MRF371	22-6155			

PROPRIETARY NOTICE

THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHEN SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC

NOTES UNLESS OTHERWISE SPECIFIED

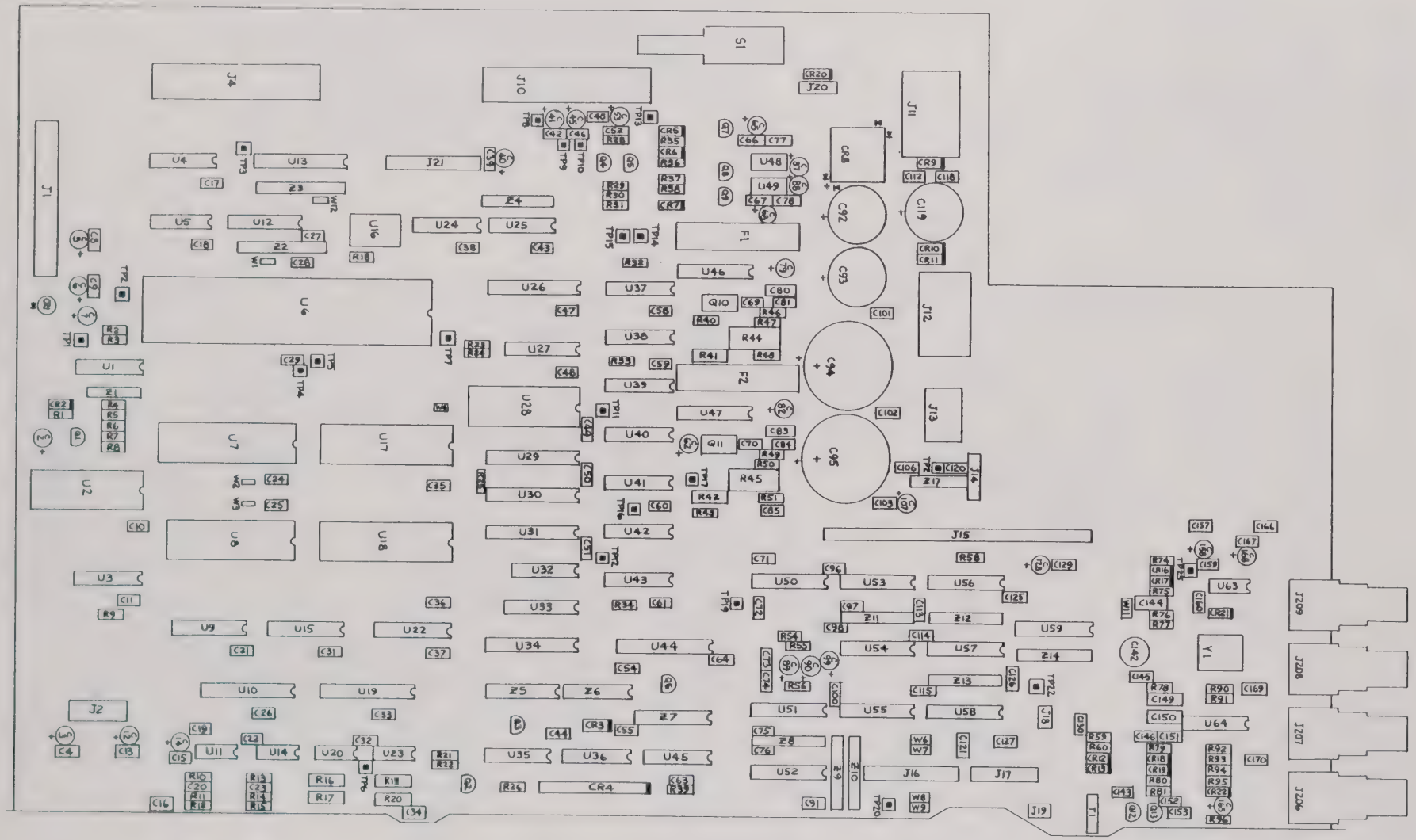
COMPONENT REF.
R3-8, 10 12-14, 16, 18-20, 23-39, 41, 42, 44-50, 52-62, 66, 68-71
C1-50
D1-3, 5-16
IC1-4 SK1
Q1-4 SK7
L1-4

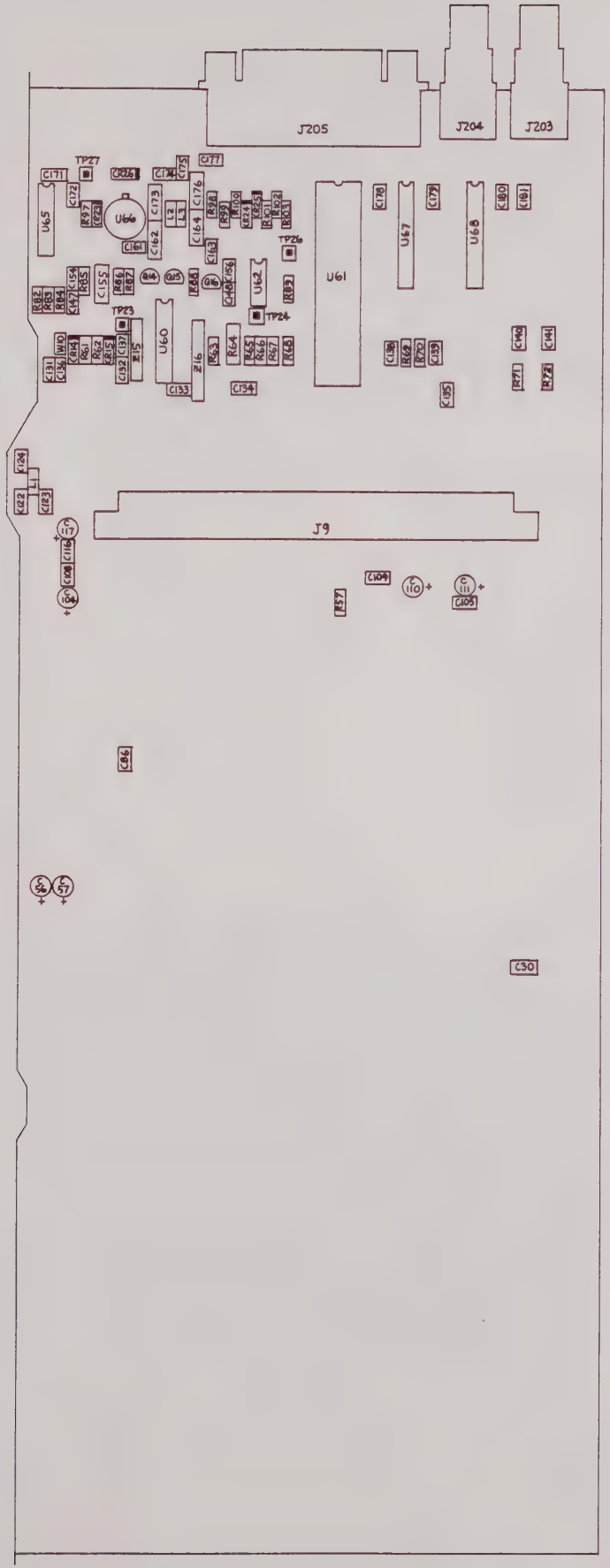
RACAL-DANA Instruments Inc.
4 GOODYEAR, IRVINE CALIFORNIA 92714

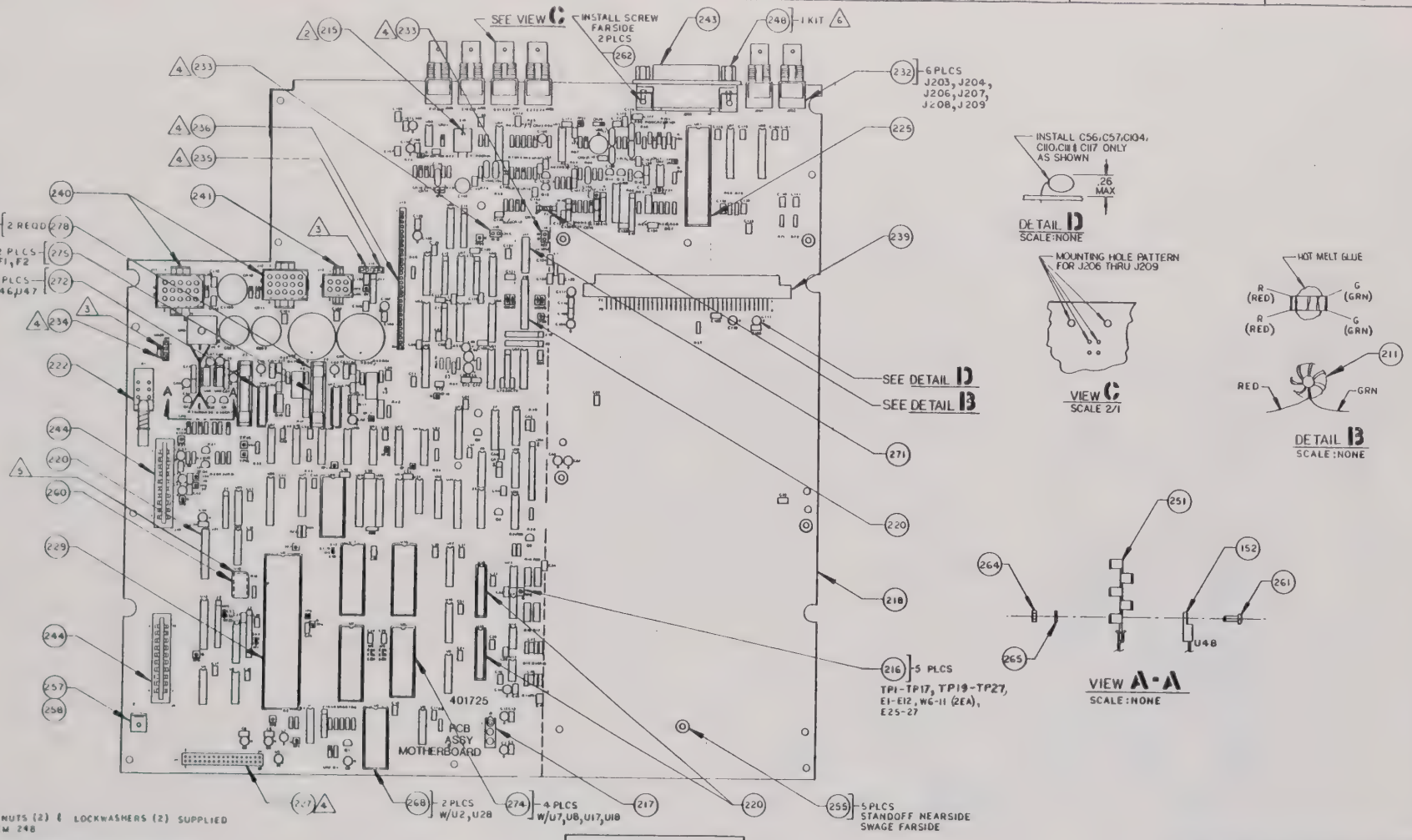
DOCUMENT TITLE: SCHEM, CHANNEL C

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	432152	A

SCALE NONE | SHEET 1 OF 1


S1
J4
J10
J20
J11
J1
U4
U13
J21
C66
C77
U48
CR8
CR9
C112
C118
C17
Z3
U49
C67
C78
C92
C119
U5
U12
U16
U24
U25
Z4
F1
C18
C27
Z2
C38
C43
R18
C28
U46
C80
U26
U37
C69
C81
Q10
R46
C47
C58
R40
R47
U6
J12
C101
R44
U38
R41
R48
U27
C52
C94
F2
C48
U39
J13
U28
U47
C102
C83
U40
Q11
C70
C84
U1
U7
U17
R49
C95
R50
C106
C120
J14
Z1
Z17
U29
R45
U41
R42
R51
C103
C85
U2
C50
U30
C60
C24
C35
C25
C10
U8
U18
U31
U42
J15
C71
C96
R58
C129
U3
U50
U53
U56
C125
C11
U32
U43
C157
C166
C167
C159
C144
C140
C121
R9
U33
R34
C61
C72
C97
C115
Z11
Z12
U59
U9
U15
U22
C98
C36
C21
C31
C37
U34
U44
R54
R55
C114
U54
U57
Z14
C42
Y1
C64
C73
C74
C54
C126
C145
U10
U19
Z5
Z6
R56
C100
C113
Z13
TP12
R78
R90
C169
J2
C26
C33
C149
U51
U55
U58
J18
C150
U64
C19
C44
CR3
C55
Z7
C75
Z8
C146
C151
C22
U11
U14
U20
U23
C32
C76
W6
W7
C121
C127
R53
R60
C130
C4
C13
C15
R21
R22
U35
U36
U45
R79
R92
C170
R10
C20
R11
R18
R13
C23
R14
R16
R17
R11
R20
C16
C34
R24
CR4
C63
R33
R80
R93
R94
R95
R22
C143
C152
C153
C91
W8
W9
J19
J16
J17
T1
J209
J208
J207
J206


J205
J204
J203
TP27
U66
U65
U61
U67
U68
TP26
U62
TP24
TP23
U60
Z16
Z15
J9
C30



6. DISCARD NUTS (2) & LOCKWASHERS (2) SUPPLIED WITH ITEM 248
5. SHARP CORNER INDICATES PIN 1 ON ITEM 282.
4. INSTALL WITH SHORT LEADS IN PCB.
3. AFTER INSTALLATION CUT PIN INDICATED FLUSH WITH HOUSING
2. SOLDER ITEM 215 TO CASE OF Y1 AS SHOWN.
1. REFERENCE SCHEMATIC 431725.

NOTES UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC. BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC

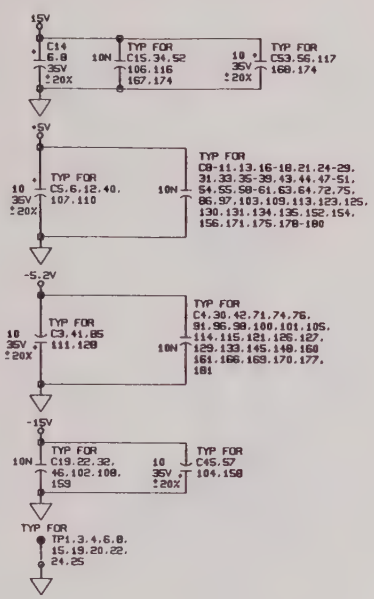
RACAL-DANA Instruments Inc.
4 GOODYEAR, IRVINE, CALIFORNIA 92714

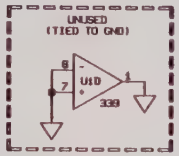
DOCUMENT TITLE: PCB ASSY, MOTHERBOARD

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	401725	J

SCALE — SHEET 1 OF 13

401725 300





Z17	
Y1	
W12	
U68	U21
TP27	
T1	
S1	
R103	R73,52,53
O16	
L3	
J209	
F2	
E27	
CR26	
C181	C1.151

HIGHEST NOT USED REF. DESIGNATIONS

REF. DES.	TYPE	PINS
Z17	10K	4.5.6
Z16	500	4.5.6.7.8
Z15	470	5.6
Z14	500	2.5.7
Z11	500	6
Z10	270	8
Z9	160	8
Z8	500	7.8
Z6	6K	11
Z4	4.7K	8
Z3	10K	10
U64E	3046	12.14
U598	10231	10.11.12. 13.14.15
U58D	10102	9.12.13.15
U57D	10102	10.11.14
U50D	10124	2.4.5.6
U37D	74LS32	11.12.13
U37C	74LS32	1.2.3

UNUSED LOGIC & NETWORKS

REF. DES.	IC TYPE	+5V PIN.NO.	+15V PIN.NO.	GND PIN.NO.	AGND PIN.NO.	DGND PIN.NO.	-5.2V PIN.NO.	-15V PIN.NO.
U68	75161	20		10				
U67	75160	20		10				
U66	710			1			4	
U65	74LS132	14		7				
U63	TL081		7					4
U62	686	1		5.6			4	
U61	9314A	40		20				
U57.58.60	10102			1.16			8	
U55.59	10231			1.16			8	
U54	10130			1.16			8	
U52	10216			1.16			8	
U51.53	10125	9		16			8	
U50.56	10124	9		16			8	
U49	7915			1				
U48	7815			2				
U42	74LS08	14		7				
U41	74LS54	14		7				
U40	74LS51	14		7				
U39	74LS04	14		7				
U38.43	74LS74	14		7				
U37	74LS32	14		7				
U33	74LS153	16		8				
U32	74LS86	14		7				
U29.31.34.44	74LS273	20		10				
U28	8254	24		12				
U27	74LS367	16		8				
U26	83048	20		10				
U25	74HC32	14		7				
U24	74F32	14		7				
U20	1404		2	4				
U17.18	27S12	28		14				
U16	OSCILLATOR	14		7				
U14.23	OP07		7					4
U13.30	74LS244	20		10				
U12	74LS148	16		8				
U11	LF412		8					4
U10.19	7545	18			2	3		
U9.15.22	74LS138	16		8				
U7.8	TMS2016P	28		14				
U6	68000	14.49		16.53				
U5	74F04	14		7				
U4	74F00	14		7				
U3	74F20	14		7				
U2	SS16A	24		12				
U1	339	3		12				

IC POWER CONNECTIONS

6. FOR LINES TERMINATED WITH (2A3),'2' INDICATES SHEET #.'A' INDICATES SHEET VERTICAL ZONE.'3' INDICATES SHEET HORIZONTAL ZONE.
5. FOR LINES TERMINATED WITH '(SHT 2)', GO TO INDICATED SHT. FOR ORIGIN.
4. CAPACITOR VALUES ARE IN MICROFARIDS.±10%,100V UNLESS OTHERWISE SPECIFIED.
3. RESISTOR VALUES ARE IN OHMS.±5%.1/4W UNLESS OTHERWISE SPECIFIED.
2. RESISTOR NETWORKS ±2%.
1. CHOKES ARE IN MICROHENRYS.

NOTES UNLESS OTHERWISE SPECIFIED

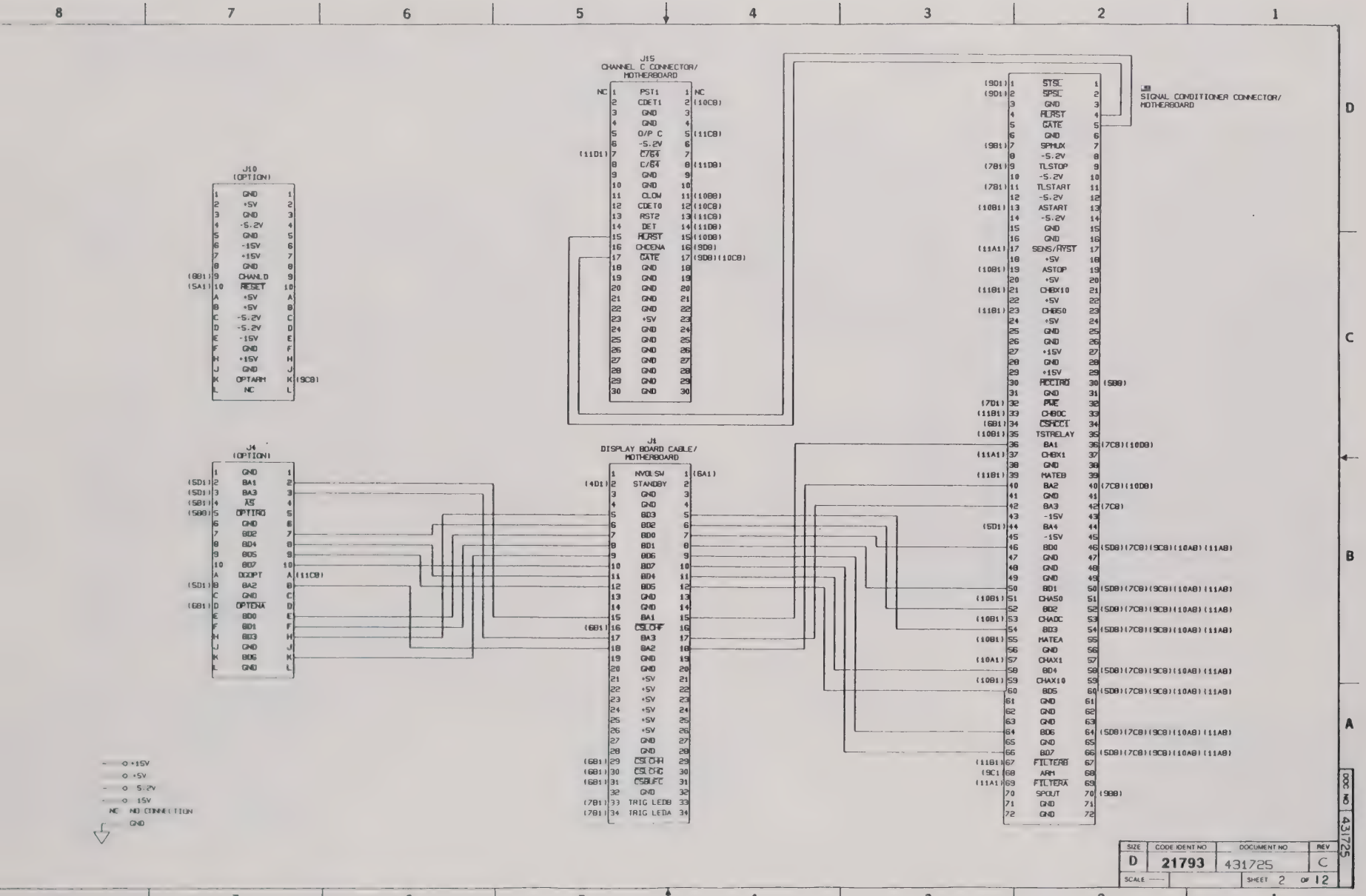
PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC. AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC

DOCUMENT TITLE
SCHEM, MOTHERBOARD

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C

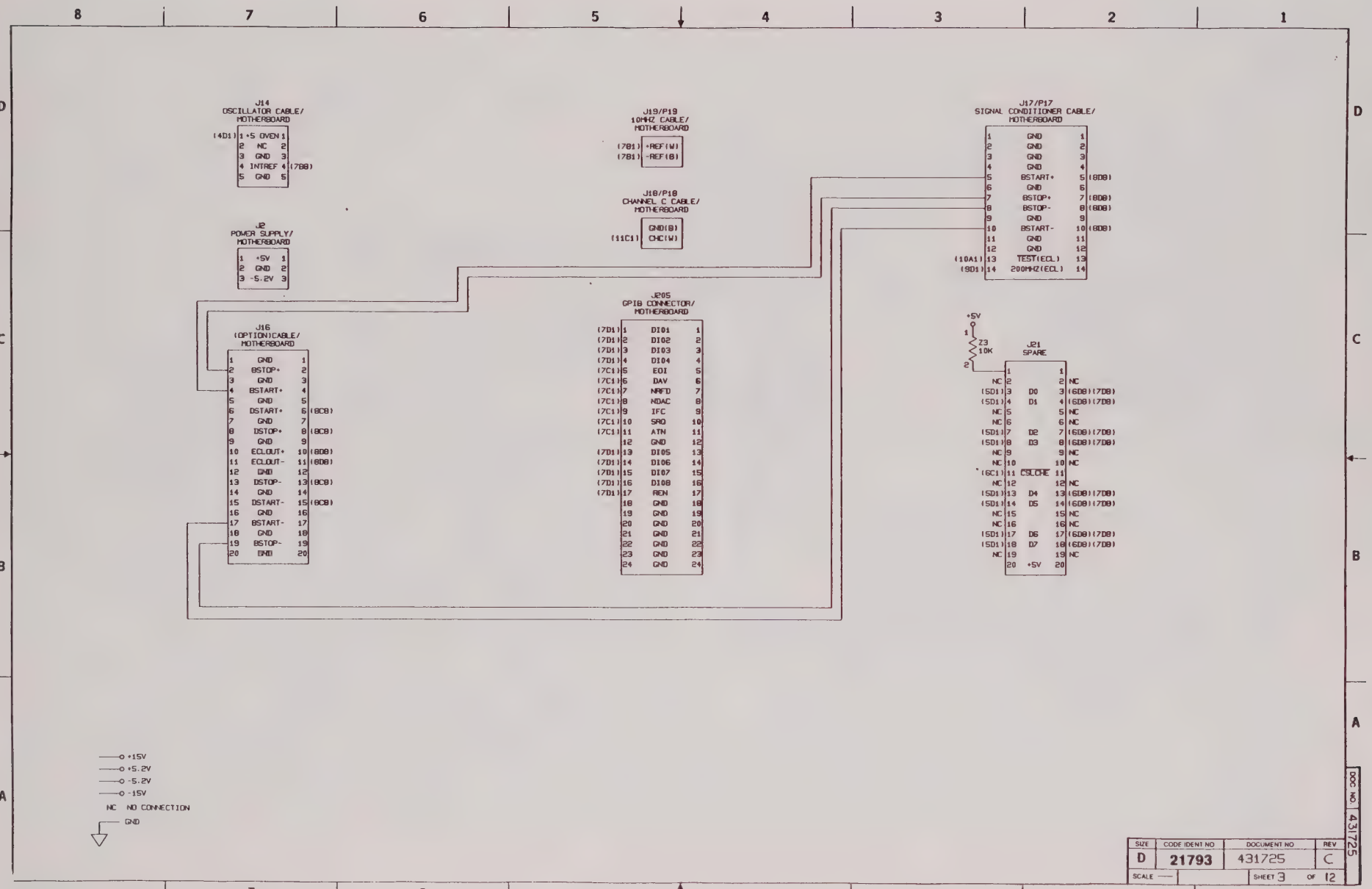
SCALE — SHEET 1 OF 12

DOC. NO. 431725



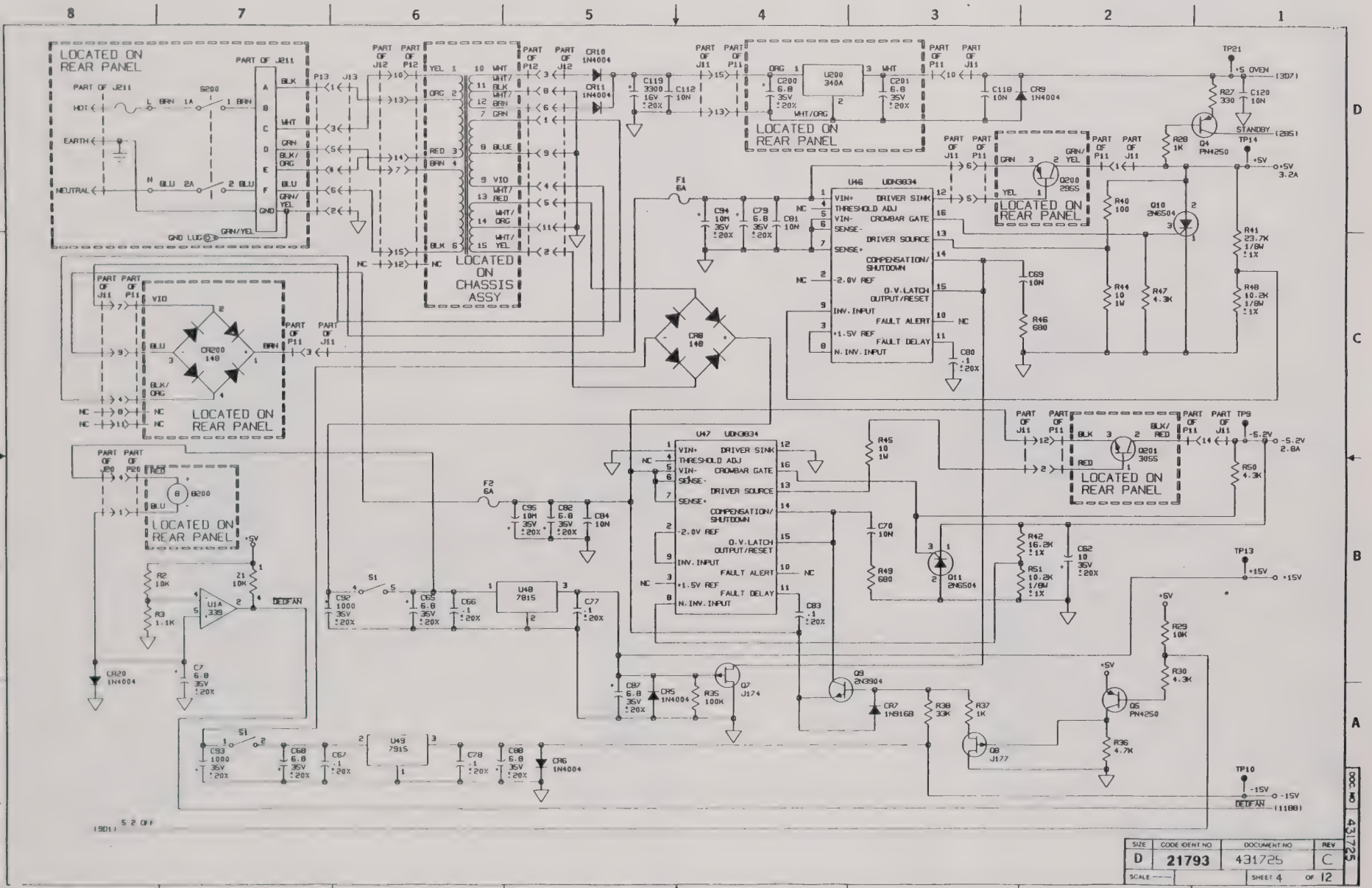
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C
SCALE —		SHEET 2 OF 12	

DOC NO 431725

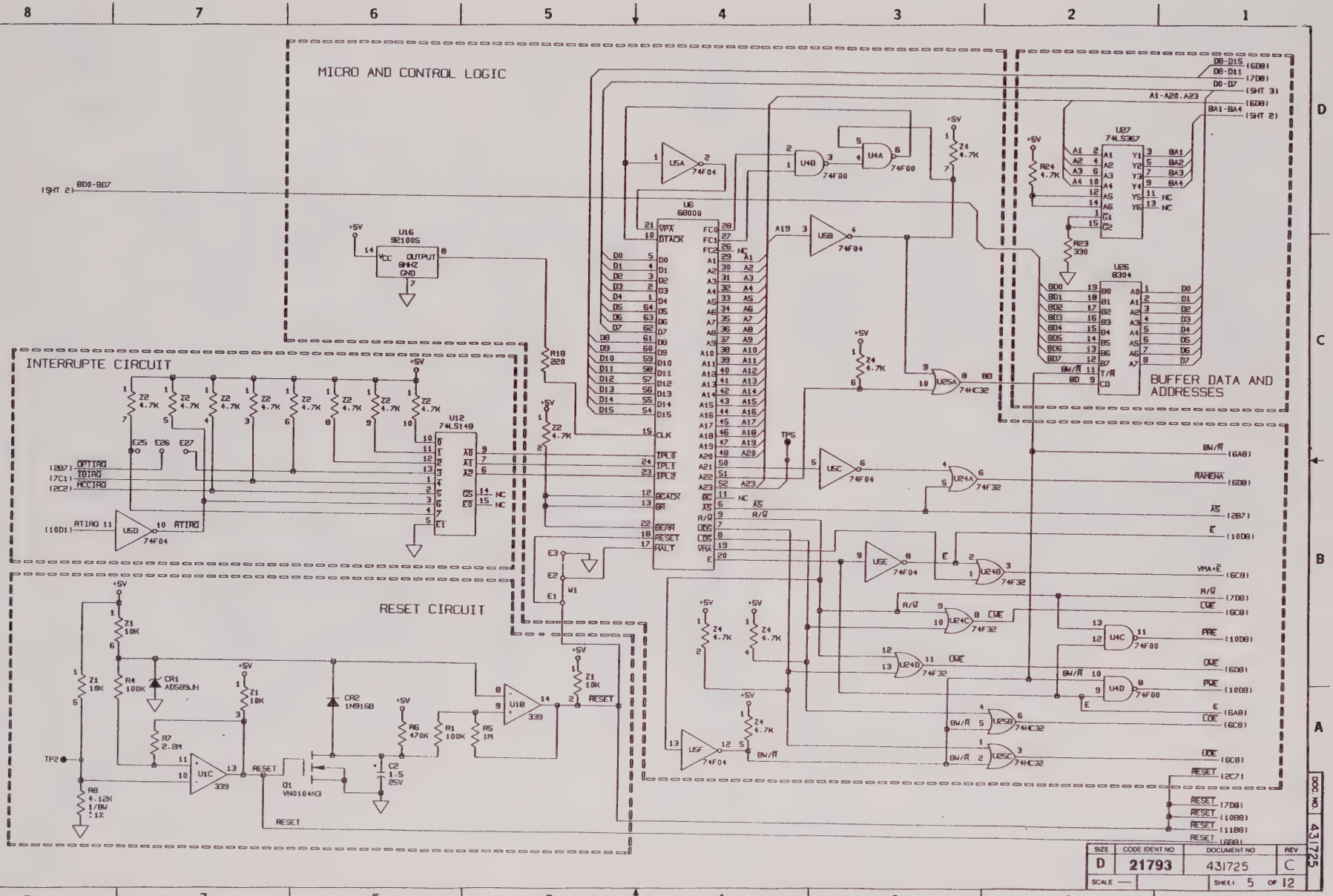


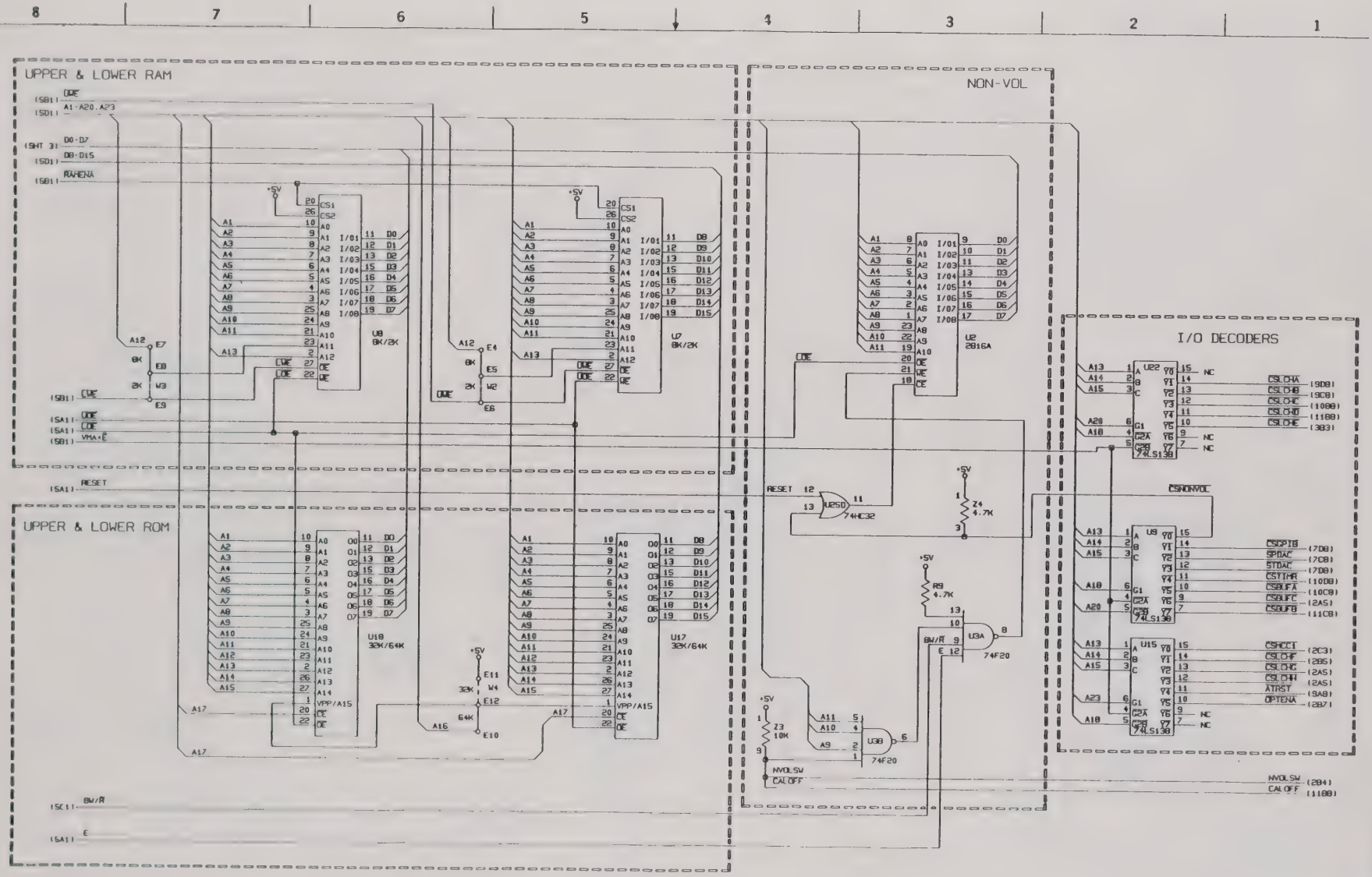
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C
SCALE —		SHEET 3 OF 12	

DOC NO 431725



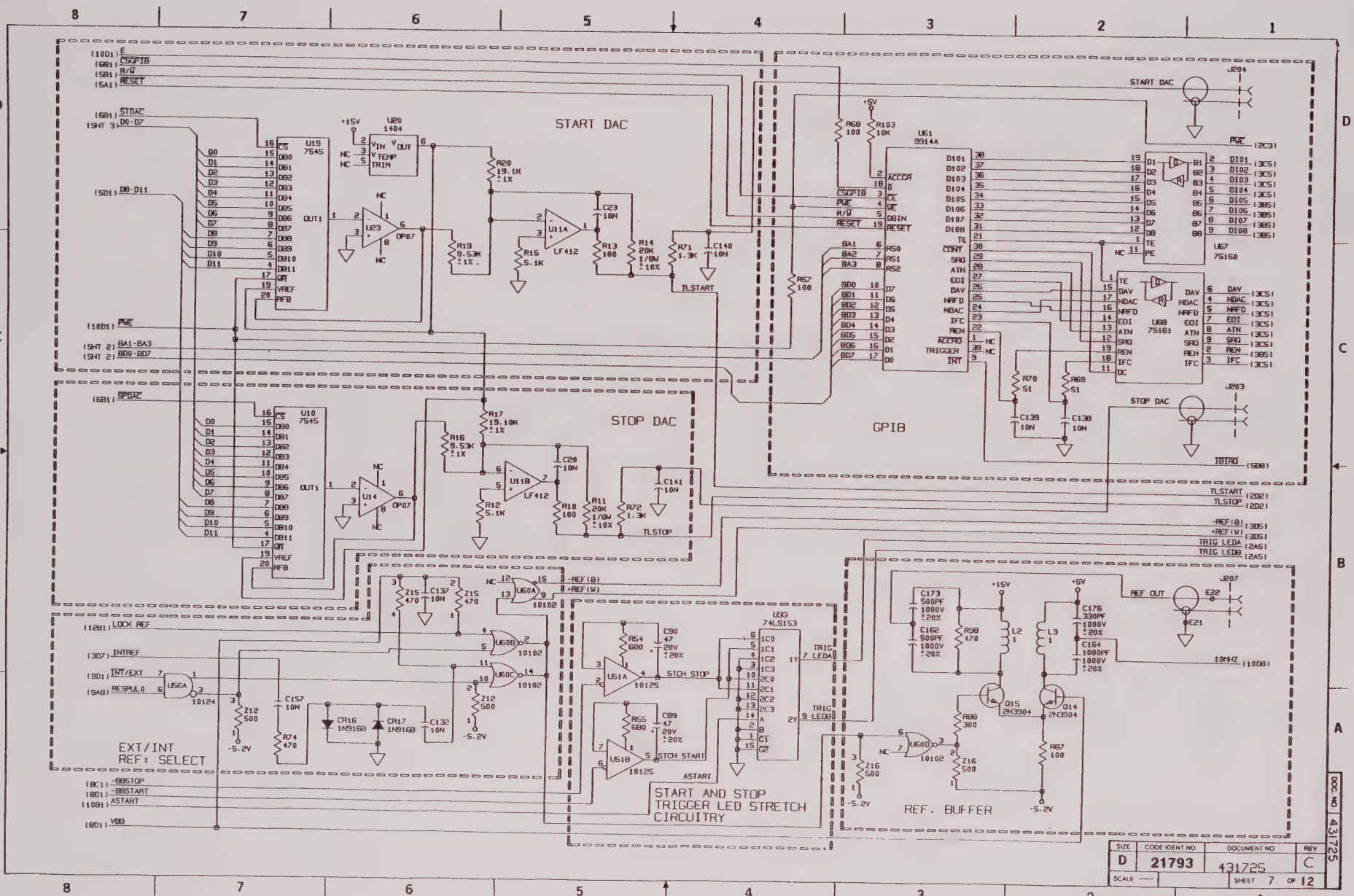
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C
SCALE ——		SHEET 4 OF 12	


MICRO AND CONTROL LOGIC
INTERRUPTE CIRCUIT
RESET CIRCUIT
BUFFER DATA AND ADDRESSES
U5 68000
U12 74LS148
U16 82100S
U26 8304
U27 74LS367
D0-D15 (6D8)
D0-D11 (7D8)
D0-D7 (SHT 3)
A1-A20,A23 (6D8)
BA1-BA4 (SHT 2)
BD0-BD7 (SHT 2)
OPTIRQ (2B7)
IBIRQ (7C1)
MCCIRQ (2C2)
RTIRQ (10D1)
RESET
TP2
TP5
R/W (7D8)
RAMENA (6D8)
AS (2B7)
E (10D8)
VMA*E (6C8)
CWE (6C8)
PRE (10D8)
UDE (6D8)
LDE (6C8)
RESET (12C7)
RESET (7D8)
RESET (10B8)
RESET (11B8)
RESET (6B8)
DOC. NO. 431725
SIZE D
CODE IDENT NO 21793
DOCUMENT NO 431725
REV C
SCALE —
SHEET 5 OF 12



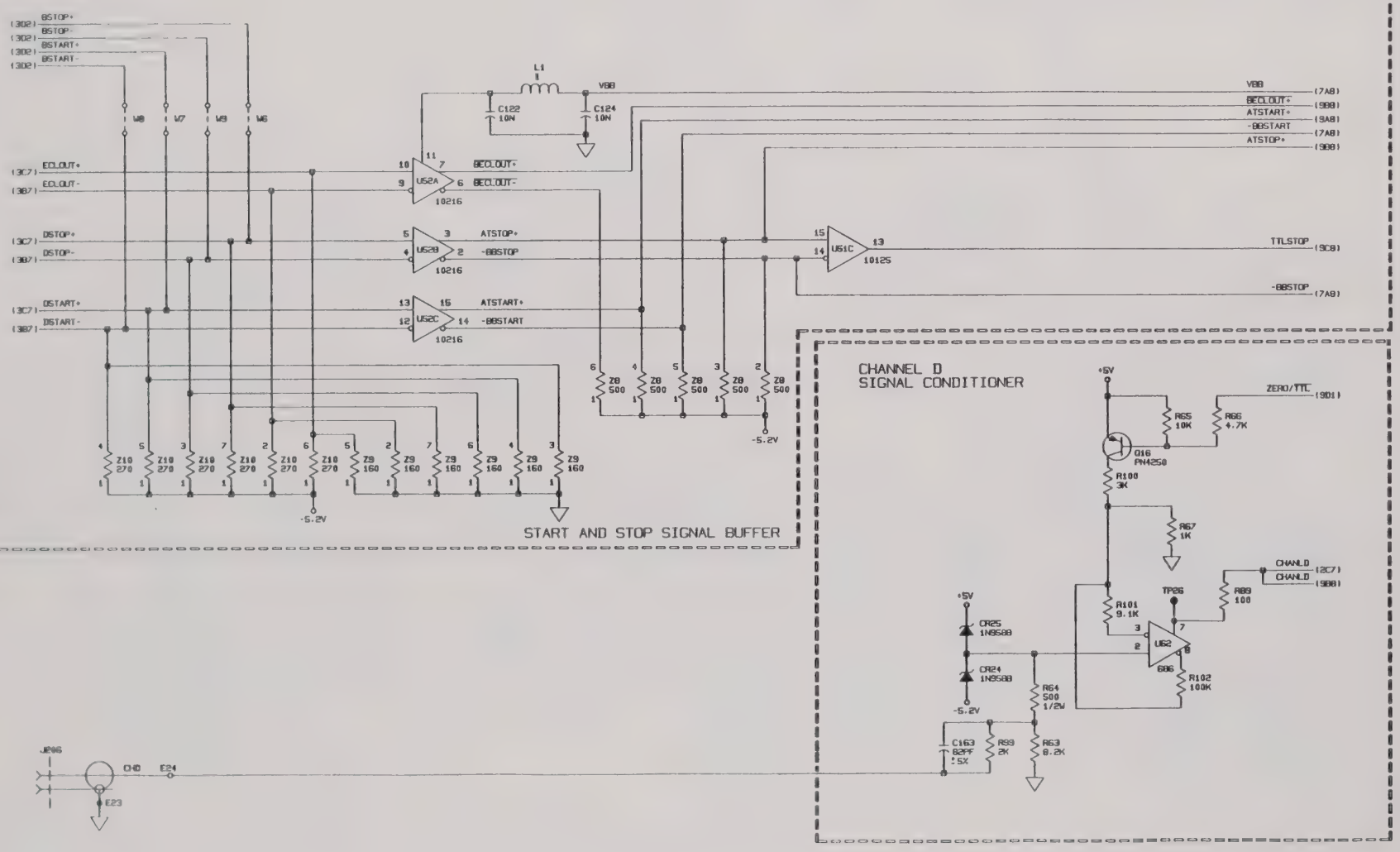
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C
SCALE —		SHEET 6 OF 12	

DOC NO 431725



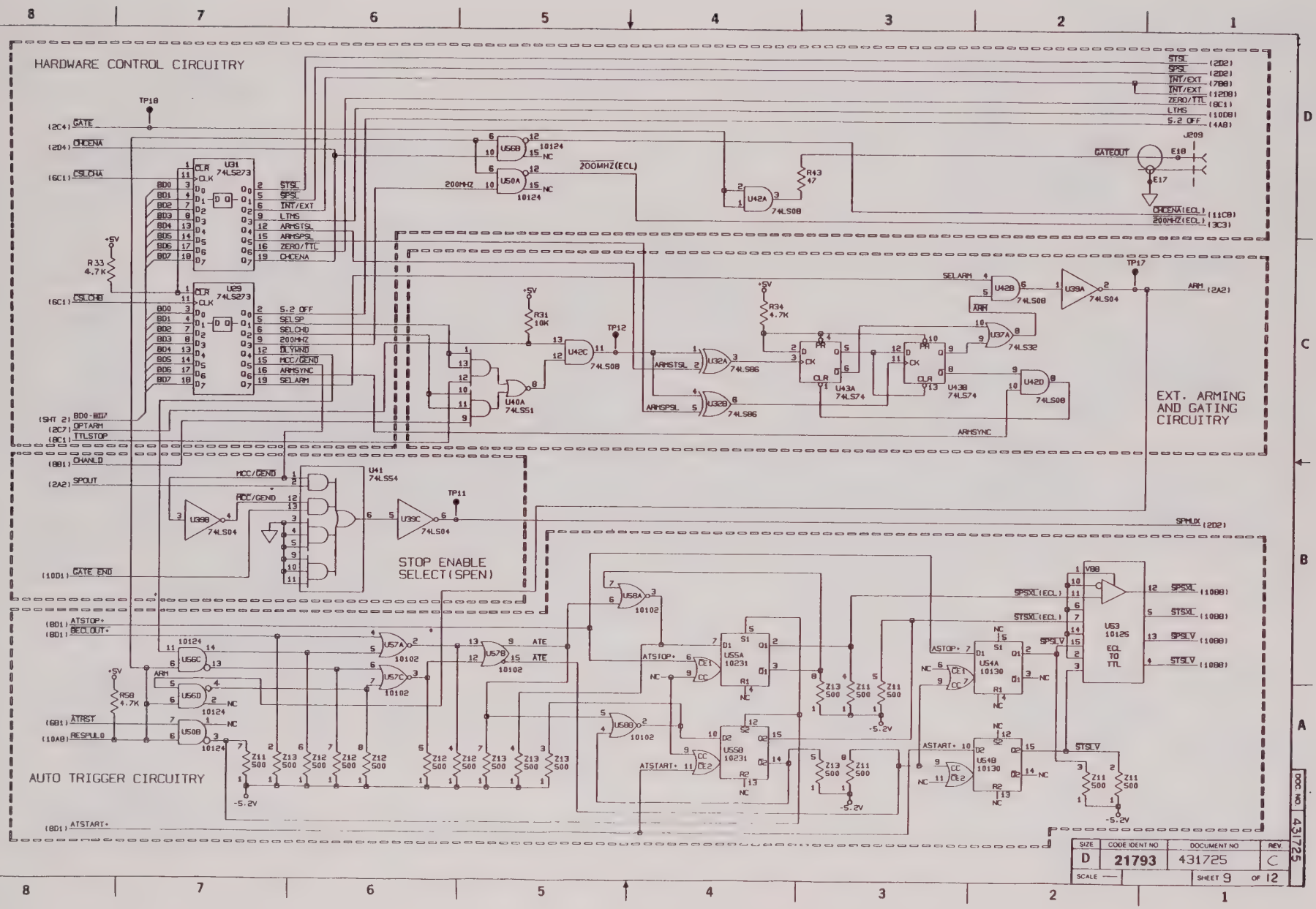
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C
SCALE —		SHEET 7 OF 12	

DOC. NO. 431725



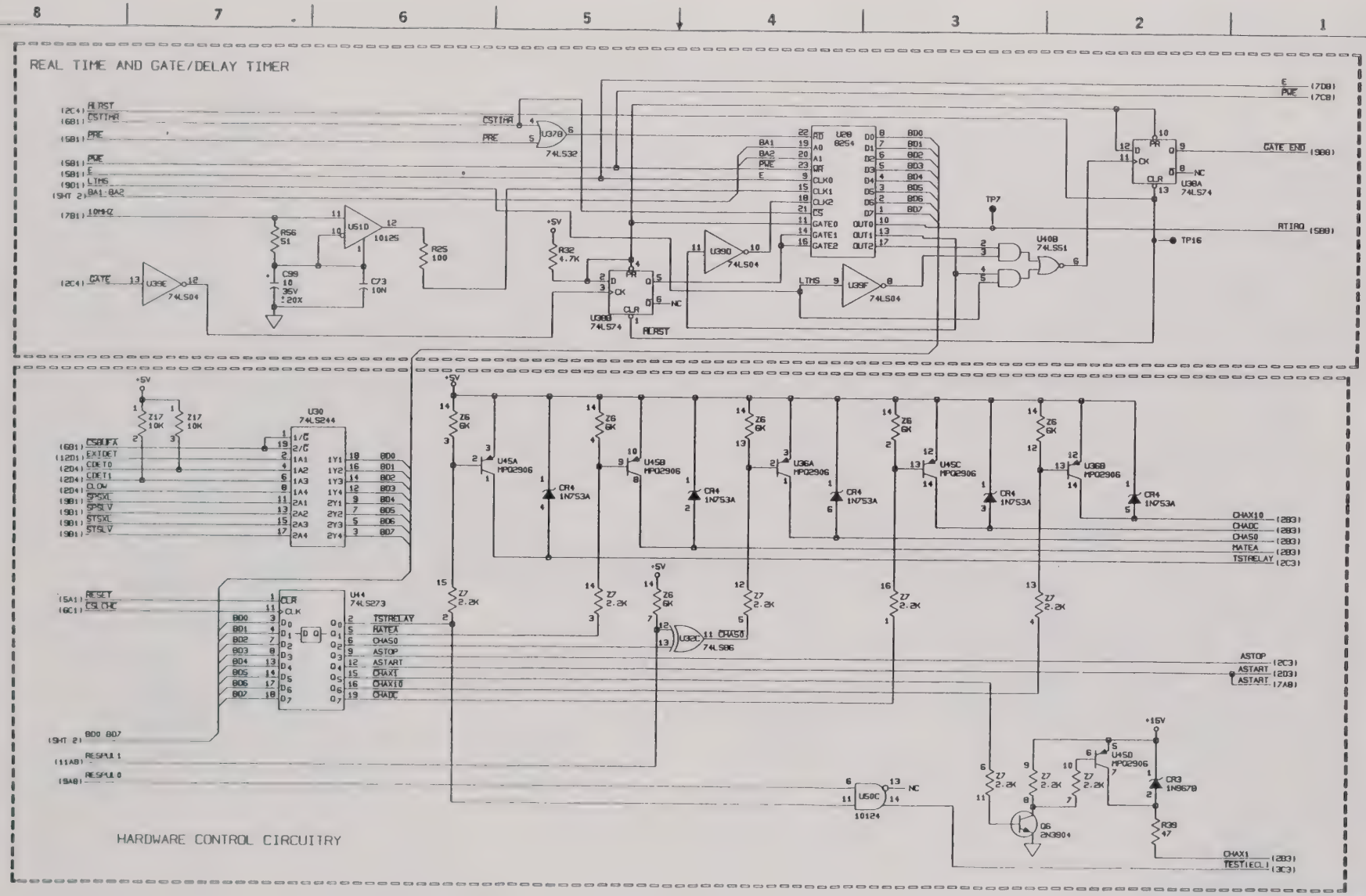
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C
SCALE —		SHEET 8 OF 12	

DOC NO 431725



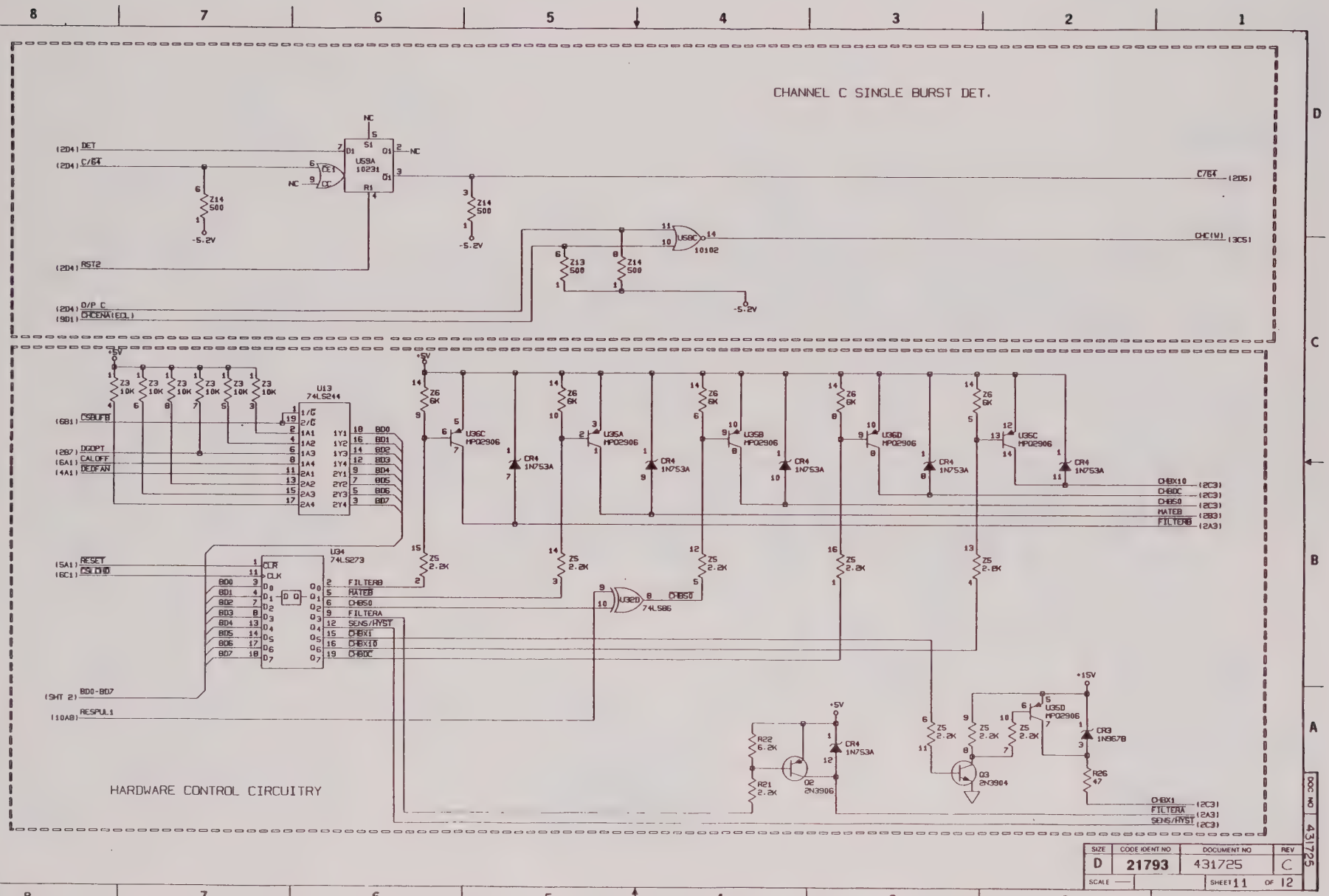
SIZE	CODE IDENT NO	DOCUMENT NO	REV.
D	21793	431725	C
SCALE —		SHEET 9 OF 12	

DOC NO 431725



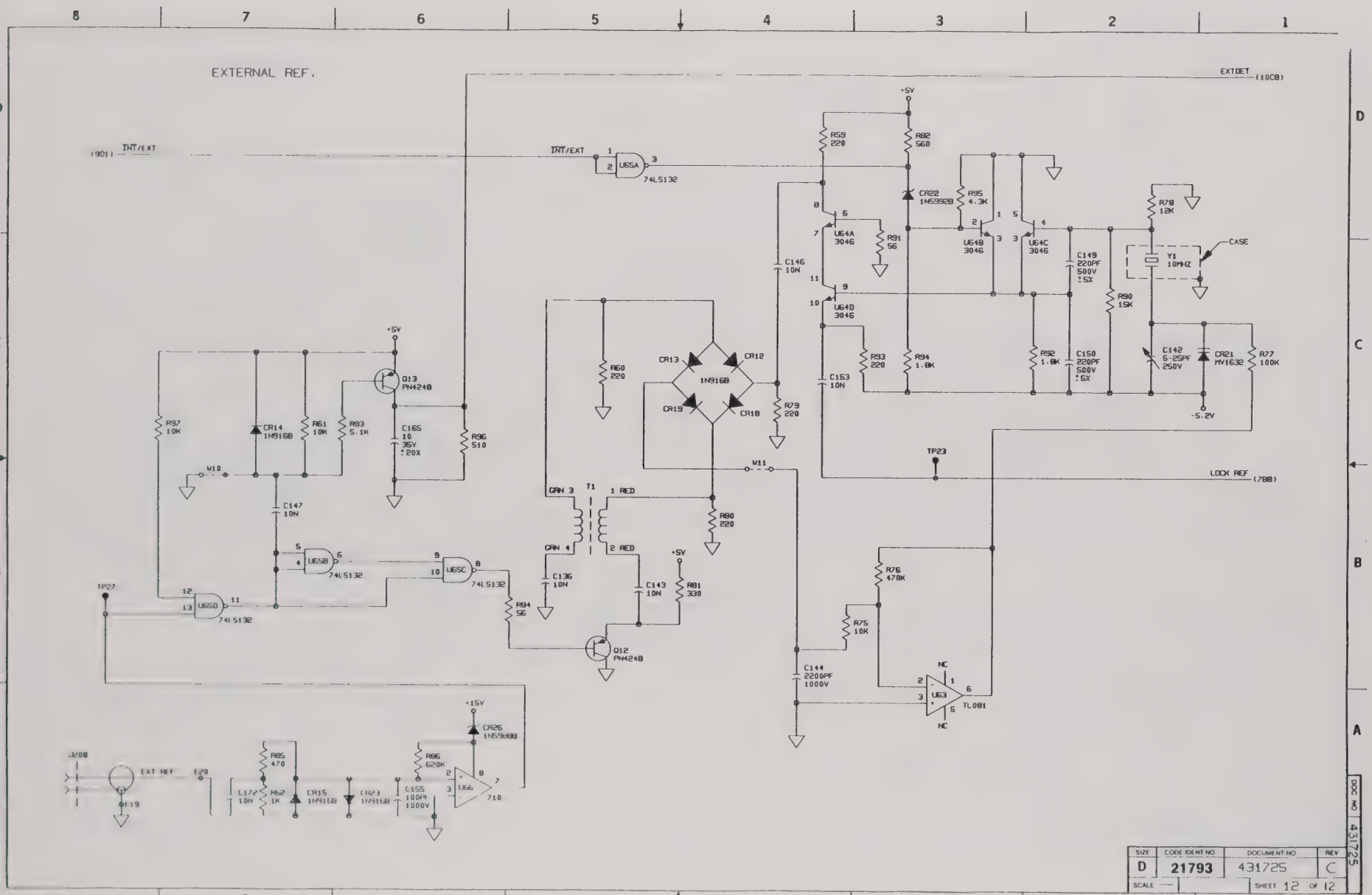
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C
SCALE —		SHEET 10 OF 12	

000 043725



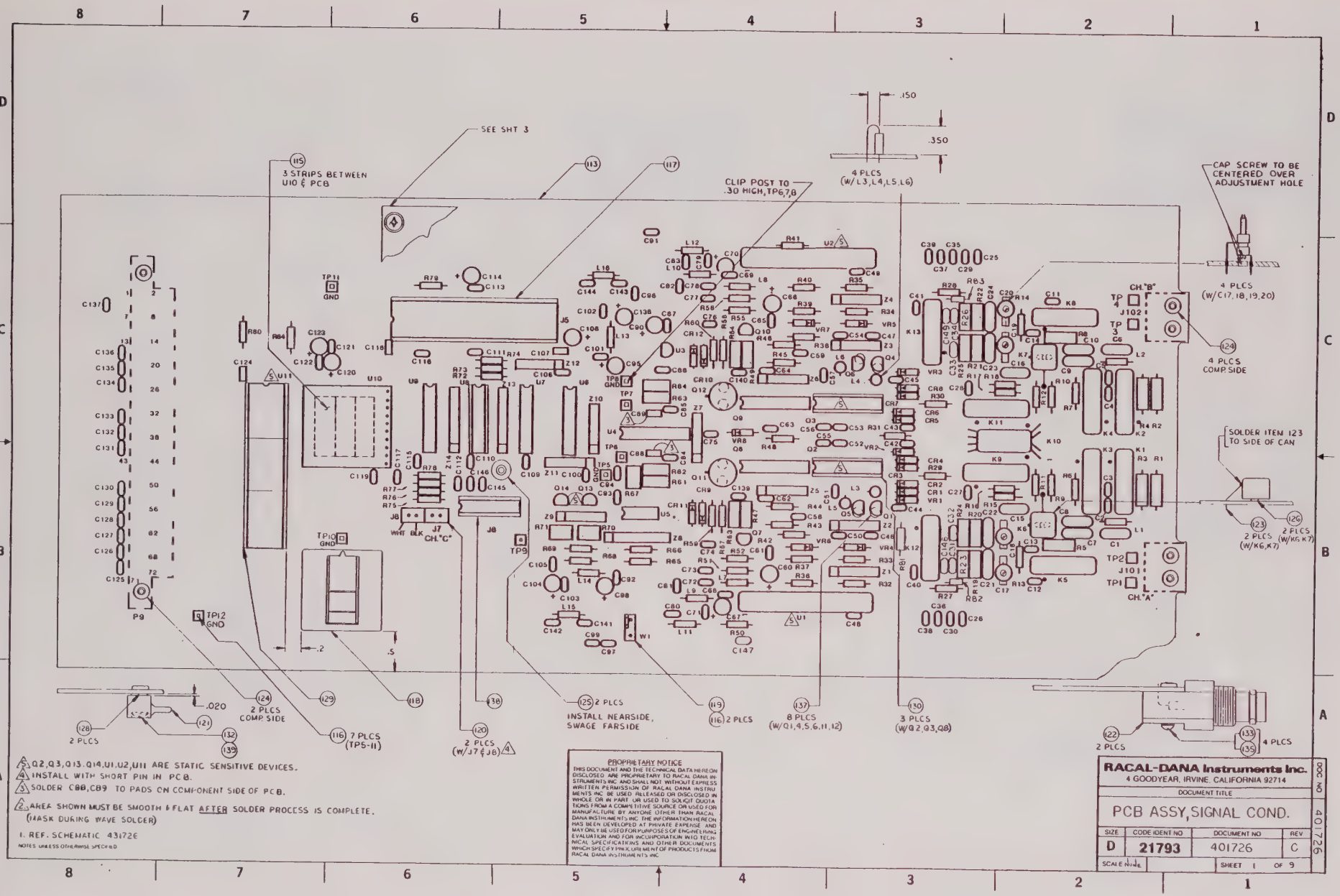
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C
SCALE —		SHEET 11 OF 12	

DOC NO 431725



SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431725	C
SCALE —		SHEET 12 OF 12	

DOC NO 431725



Q2,Q3,Q13,Q14,U1,U2,U11 ARE STATIC SENSITIVE DEVICES.

INSTALL WITH SHORT PIN IN PCB.

SOLDER C88,C89 TO PADS ON COMPONENT SIDE OF PCB.

AREA SHOWN MUST BE SMOOTH & FLAT AFTER SOLDER PROCESS IS COMPLETE. (MASK DURING WAVE SOLDER)

1. REF. SCHEMATIC 431726

NOTES UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE

THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC

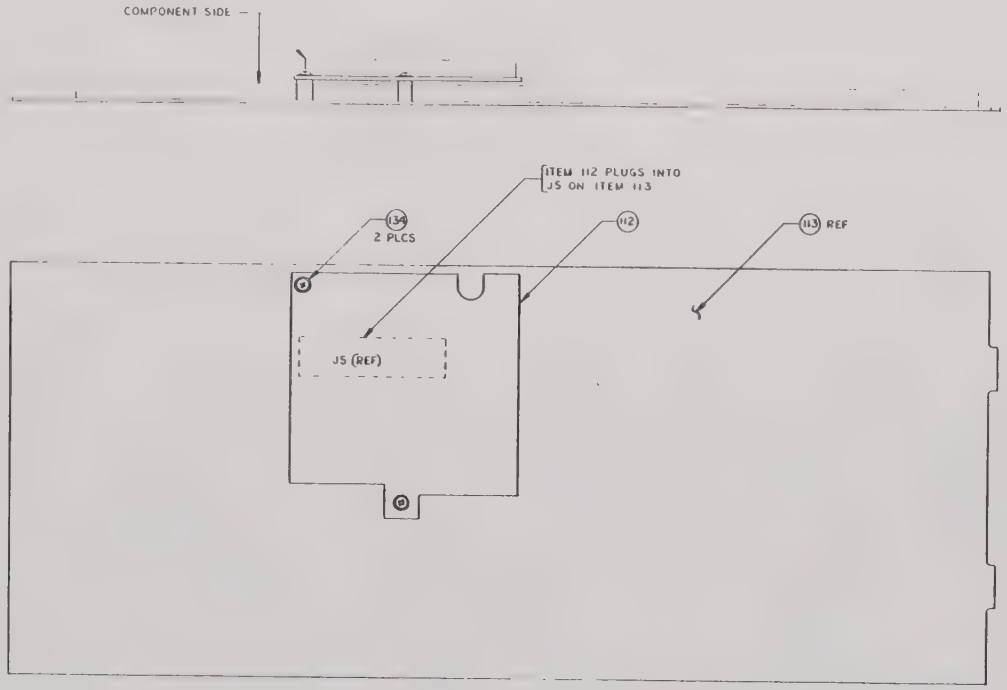
RACAL-DANA Instruments Inc.
4 GOODYEAR, IRVINE, CALIFORNIA 92714

DOCUMENT TITLE: PCB ASSY, SIGNAL COND.

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	401726	C

SCALE NONE | SHEET 1 OF 9

DOC NO 401726

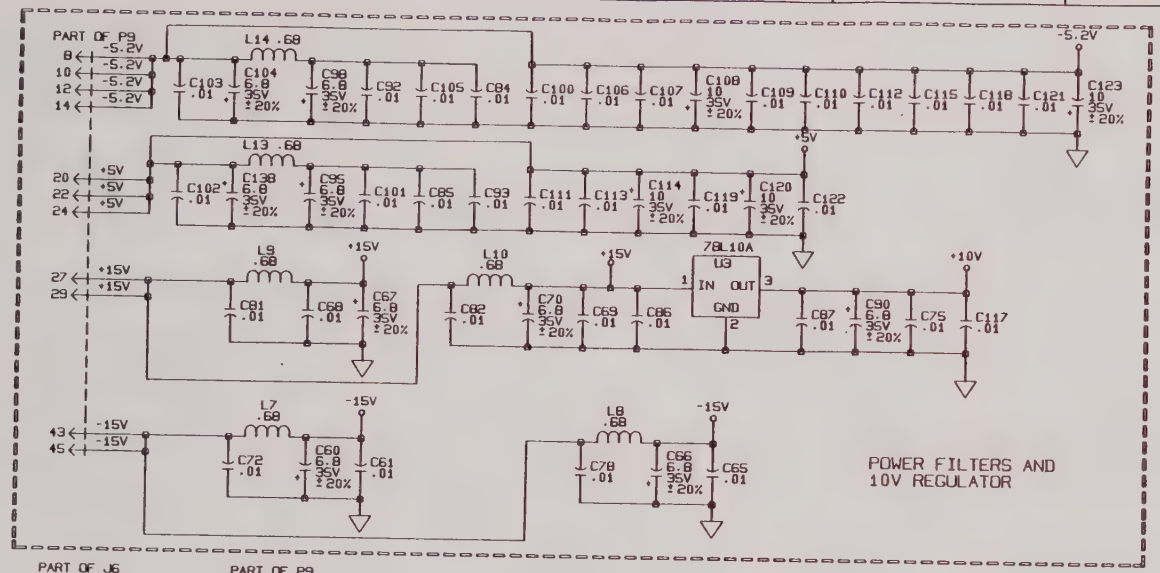


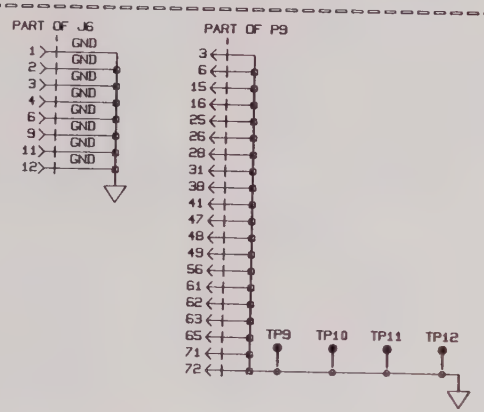
PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREIN DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC. AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC. BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREIN HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC.

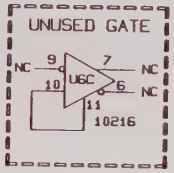
NOTES: UNLESS OTHERWISE SPECIFIED

RACAL-DANA Instruments Inc. 4 GOODYEAR, IRVINE, CALIFORNIA 92714			
DOCUMENT TITLE: PCB ASSY, SIGNAL COND.			
SIZE: D	CODE IDENT NO: 21793	DOCUMENT NO: 401726	REV: C
SCALE: None		SHEET 3 OF 9	

401726







Z14	Z11
W1	
VR8	
U11	
TP12	
R84	
D14	
P9	
L16	
K13	
J102	
CR12	
C149	
HIGHEST	NOT USED

REF. DESIGNATIONS

Z13	330	4,5	
Z10	330	4	
Z7	33	4	(GND)
Z6	330	4	
Z5	330	4	
Z4	2.2K	5,6	(GND)
Z3	470	3,4	(GND)
Z2	470	3,4	(GND)
Z1	2.2K	5,6	(GND)
Q9	SL3127C	1,15,16	
Q8	SL3127C	1,15,16	
REF DES	TYPE	PINS	

UNUSED LOGIC & NETWORKS

J5	CONNECTOR	10,29,31			11,21,30,35,40	1,20	
Q8,9	SL3127C				5		
Q2,3	SDS000N						2,15
U11	MCC1				16,36		
U10	1034	2	3		7,9	5	
U8	10231				1,16	8	
U7	10H158				16	8	
U6,9	10216				1,16	8	
U5	2903	8					4
U4	9687	11			3,14	6	
U1,2	230753	15			7,14		1
REF. DES.	IC TYPE	+5V PIN.NO.	+10V PIN.NO.	+15V PIN.NO.	GND PIN.NO.	-5.2V PIN.NO.	-15V PIN.NO.

IC POWER CONNECTIONS

4. CAPACITOR VALUES ARE IN MICROFARIDS. ±10%,100V UNLESS OTHERWISE SPECIFIED.
3. RESISTOR VALUES ARE IN OHMS, ±1%,1/4W UNLESS OTHERWISE SPECIFIED.
2. RESISTOR NETWORKS ±2%.
1. CHOKES ARE IN MICROHENRYS ±10%.

NOTES UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC

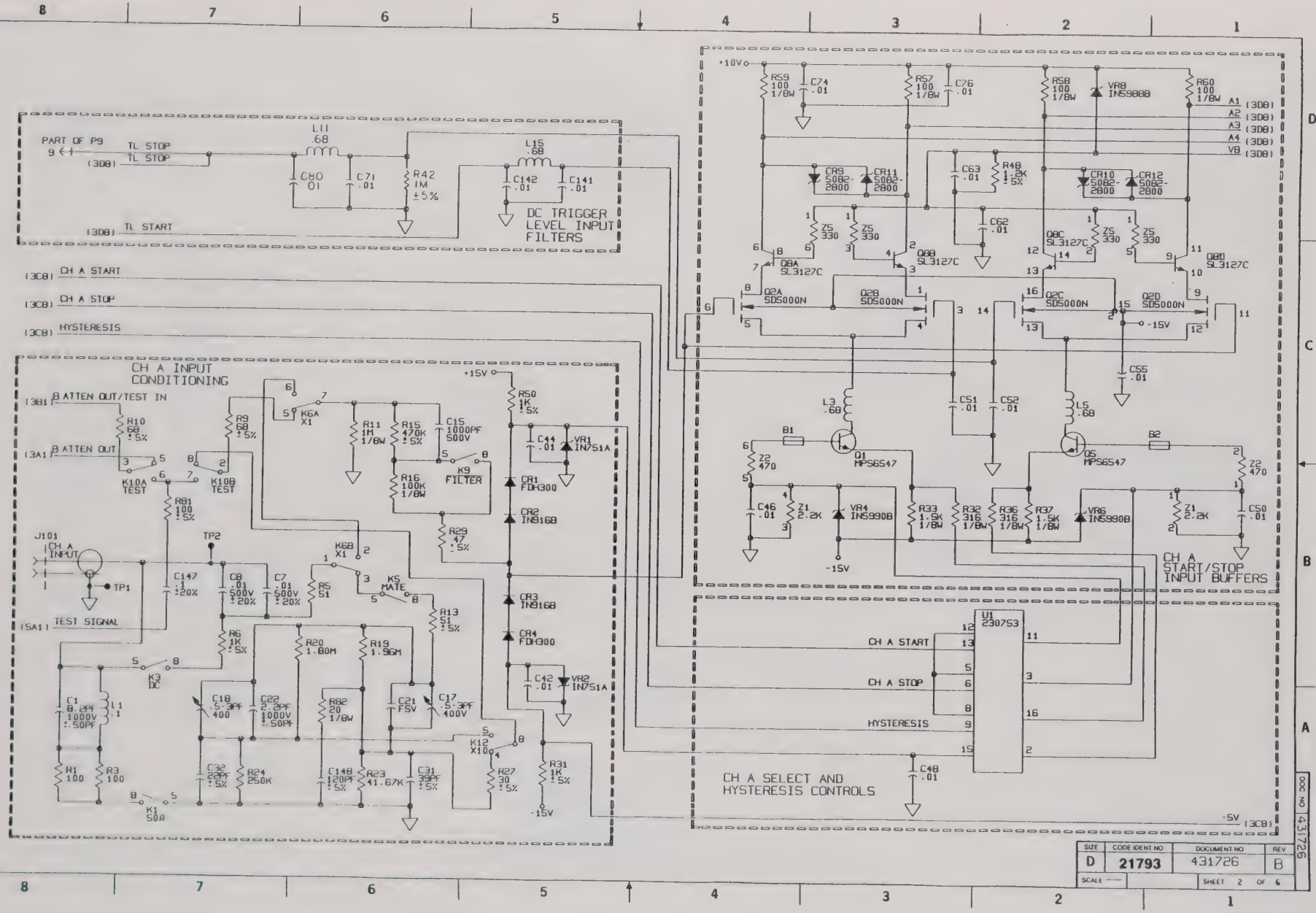
RACAL-DANA Instruments Inc.
4 GOODYEAR, IRVINE, CALIFORNIA 92714

DOCUMENT TITLE: SCHEM, SIGNAL COND

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431726	B

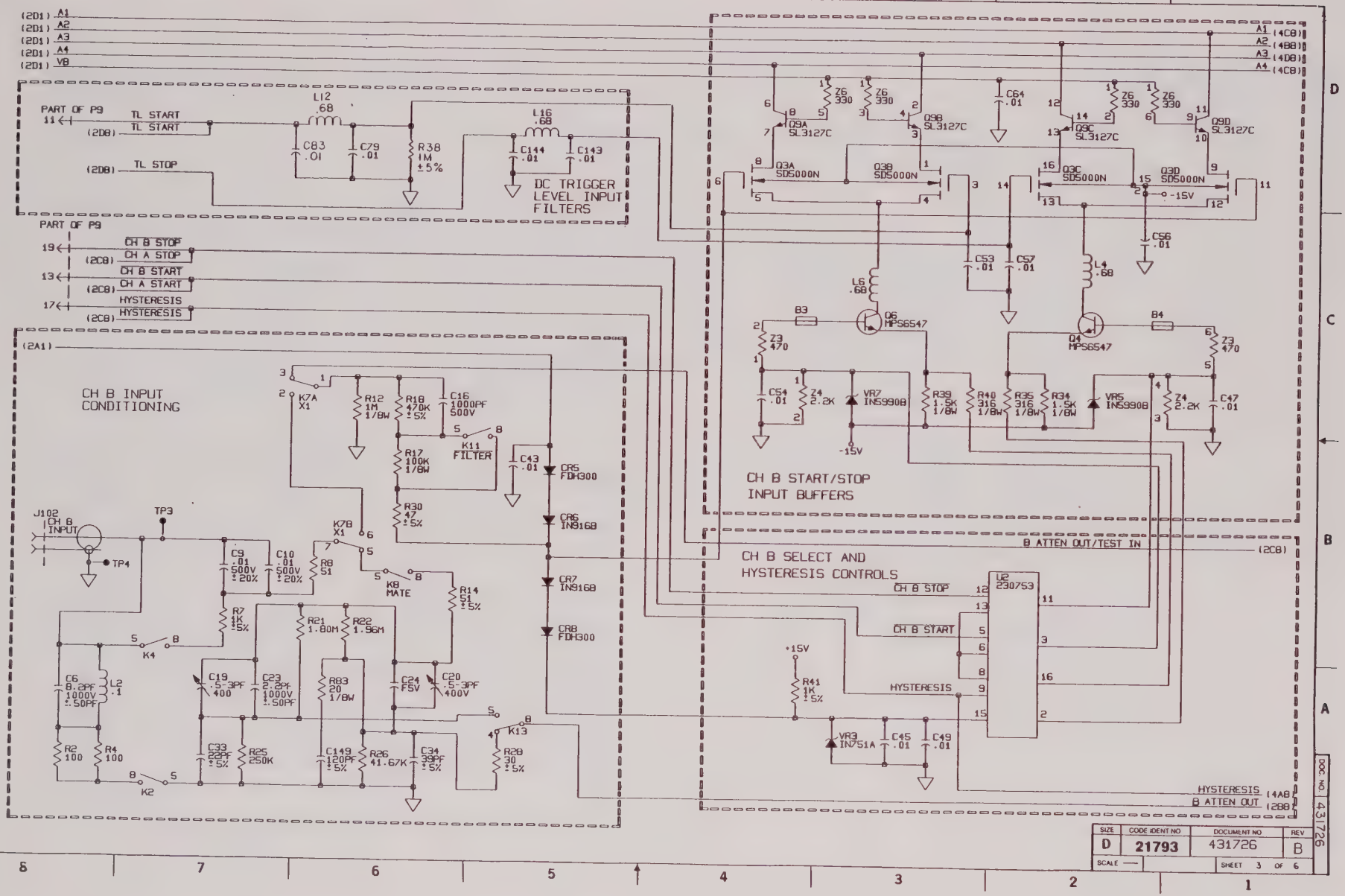
SCALE — SHEET 1 OF 6

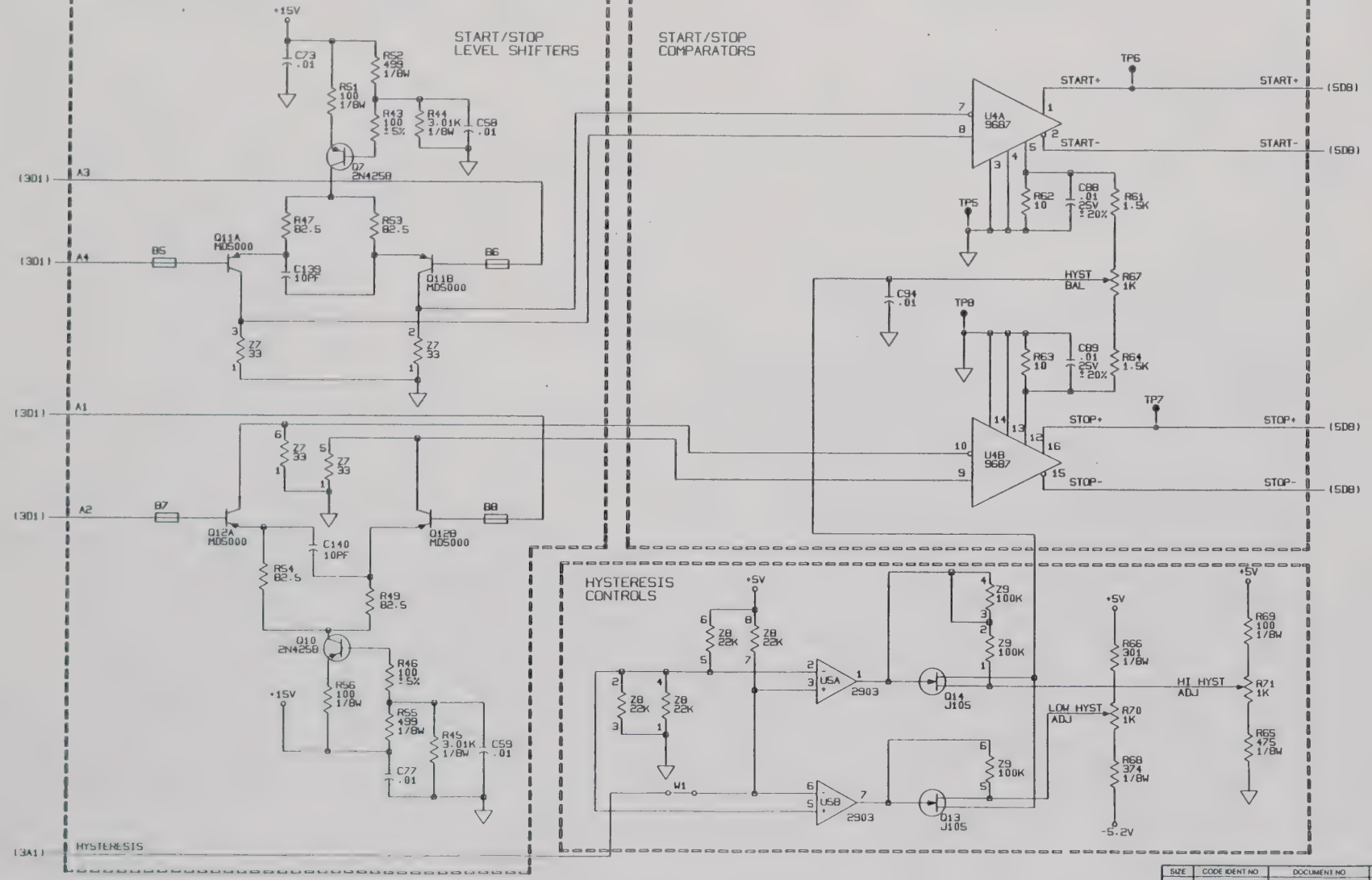
DOC NO 431726



SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431726	B
SCALE —		SHEET 2 OF 6	

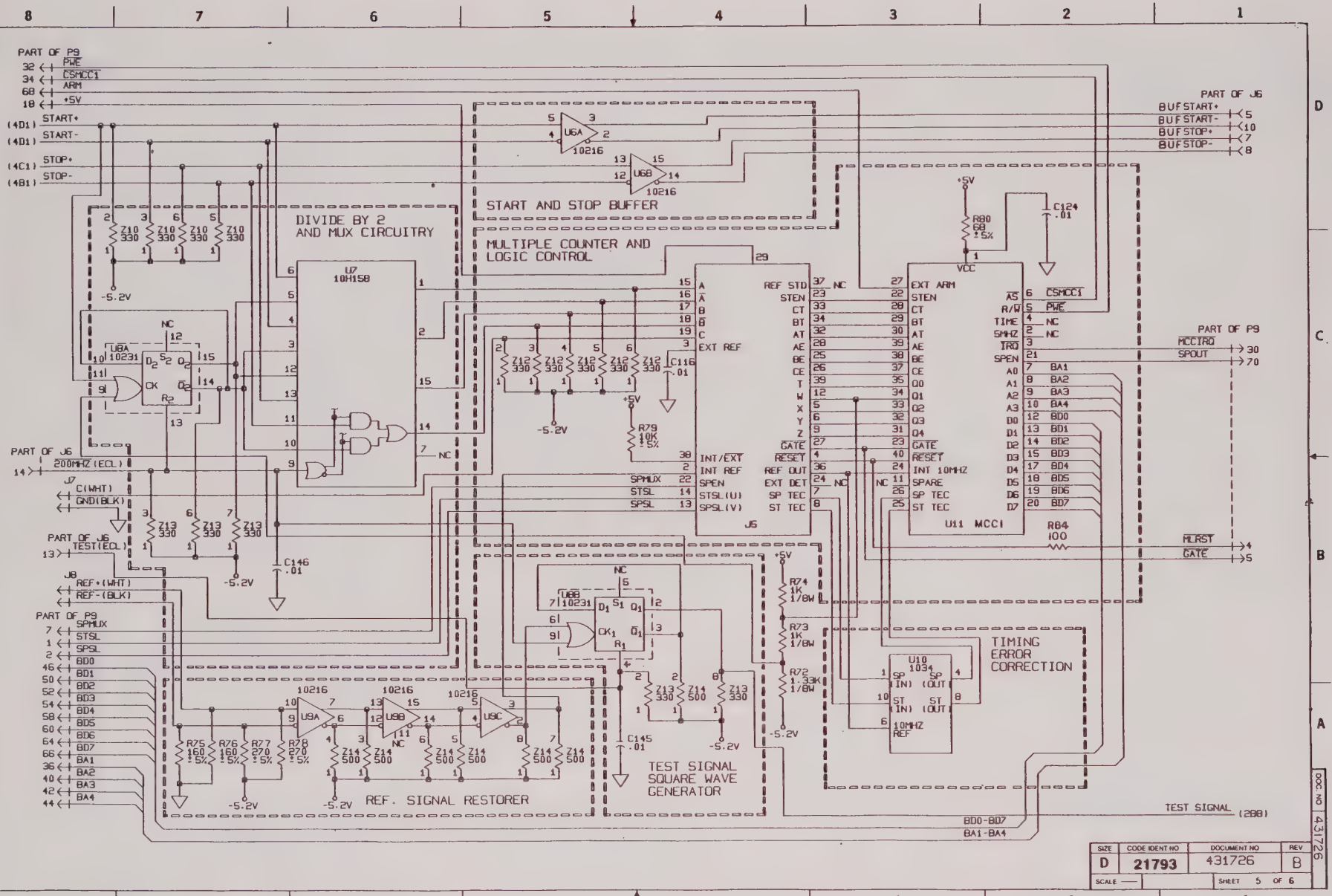
DO NOT SCALE 431726


CH B INPUT CONDITIONING
DC TRIGGER LEVEL INPUT FILTERS
CH B START/STOP INPUT BUFFERS
CH B SELECT AND HYSTERESIS CONTROLS
PART OF P9
TL START
TL STOP
CH B STOP
CH A STOP
CH B START
CH A START
HYSTERESIS
J102 CH B INPUT
TP3
TP4
K7A X1
K7B X1
K11 FILTER
K8 MATE
K4
K2
K13
CR5 FDH300
CR6 IN9168
CR7 IN9168
CR8 FDH300
Q9A SL3127C
Q9B SL3127C
Q9C SL3127C
Q9D SL3127C
Q3A SD5000N
Q3B SD5000N
Q3C SD5000N
Q3D SD5000N
Q6 MPS6547
Q4 MPS6547
U2 230753
VR7 IN5990B
VR5 IN5990B
VR3 IN751A
-15V
+15V
B ATTEN OUT/TEST IN
HYSTERESIS
B ATTEN OUT
SIZE D
CODE IDENT NO 21793
DOCUMENT NO 431726
REV B
SCALE —
SHEET 3 OF 6
DOC NO 431726



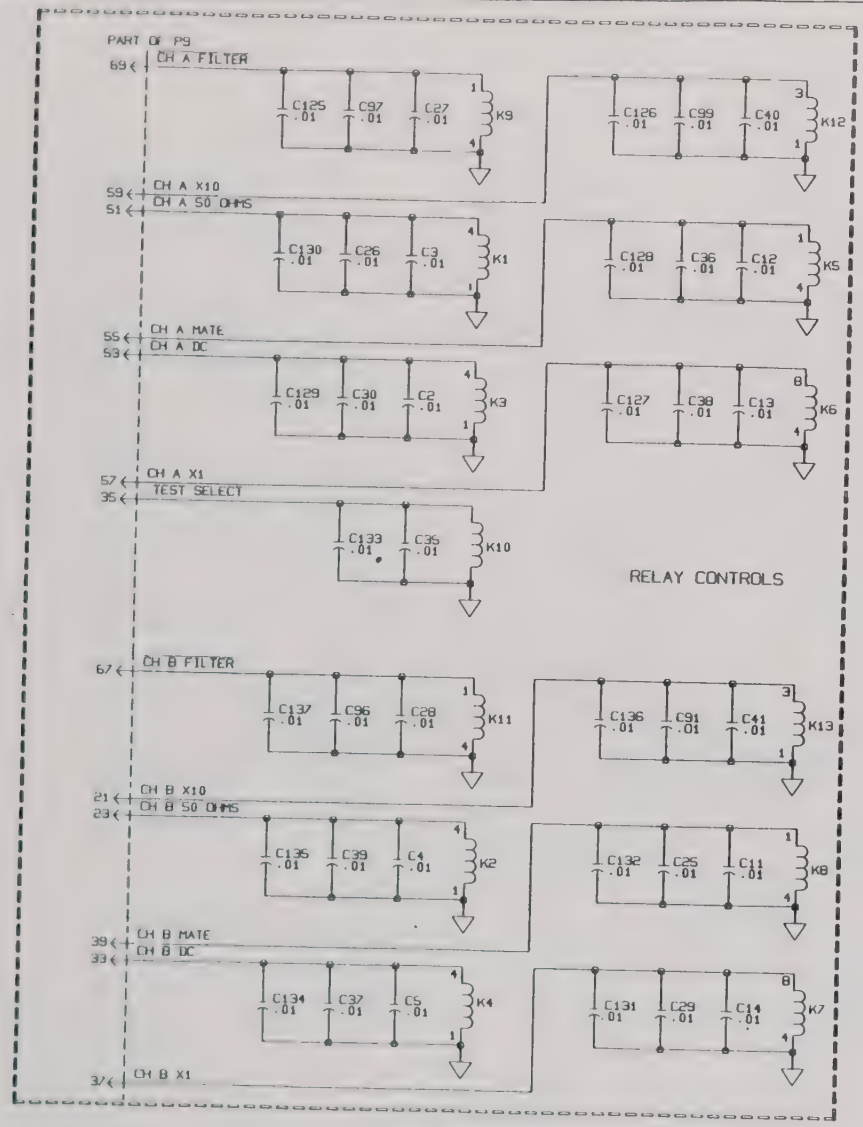
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431726	B
SCALE —		SHEET 4 OF 6	

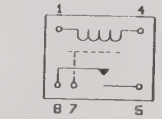
DOC NO 431726



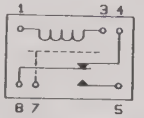
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431726	B
SCALE —		SHEET 5 OF 6	

DOC NO 431726

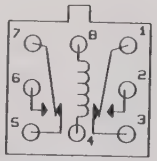




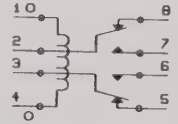
RELAY BOTTOM VIEW
TYP 8 PLCS
K1,2,3,4,5,8,9 & 11



RELAY BOTTOM VIEW
TYP 2 PLCS
K12 & K13



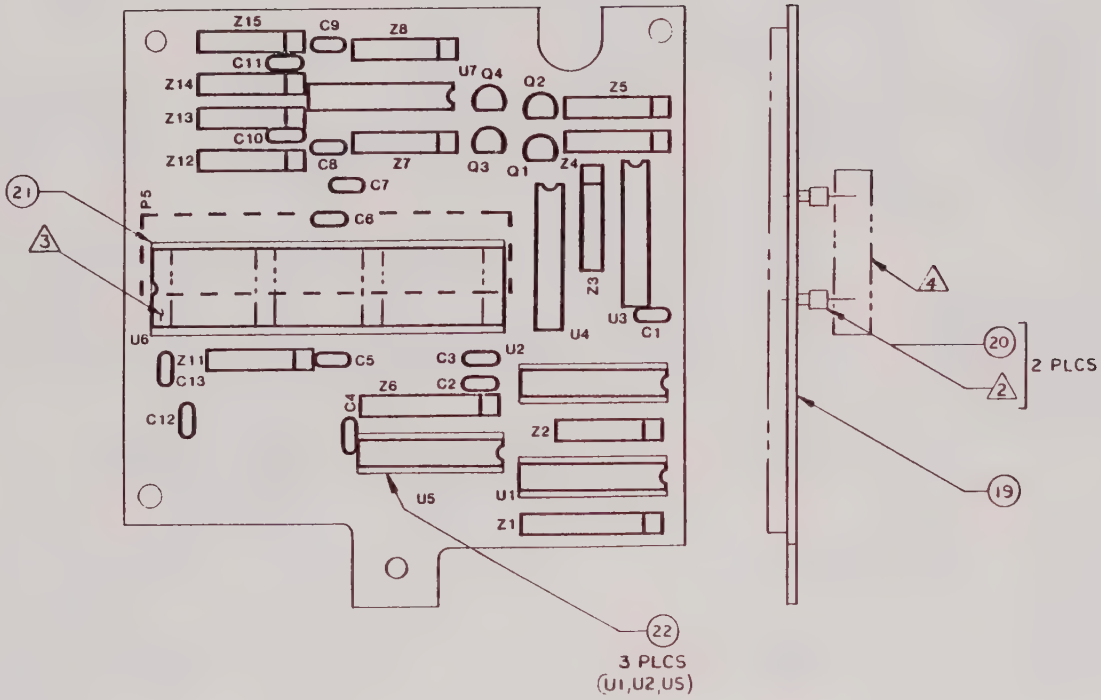
RELAY BOTTOM VIEW
TYP 2 PLCS
K6 & K7



RELAY TOP VIEW
K10

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431726	B
SCALE ——		SHEET 6 OF 6	

DOC NO 431726



4 ITEM 20 PINS TO BE PROTECTED FROM DAMAGE DURING HANDLING AND STORAGE USING FOAM PAD. (REF. P/N 454754)

3 CROSS BARS ON ITEM 21 TO BE CLIPPED FLUSH TO SOCKET SIDES AFTER WAVE SOLDER.

2 ITEM NO. 20 TO BE PERPENDICULAR AND FIRMLY SEATED ON PCB.

1. REF. SCHEMATIC 431728.

NOTES UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREIN DISCLOSED ARE PROPRIETARY TO GARA INSTRUMENTS INC AND SHALL NOT, WITHOUT EXPRESS WRITTEN PERMISSION OF GARA INSTRUMENTS INC BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE EXCEPT AS REQUIRED FOR MANUFACTURE BY ANYONE OTHER THAN GARA INSTRUMENTS INC THIS RESTRICTION DOES NOT LIMIT THE RIGHT TO USE INFORMATION CONTAINED ON THIS SHEET IF IT IS OBTAINED FROM ANOTHER SOURCE LAWFULLY AND WITHOUT RESTRICTION

PCB ASSY, AMCC2 SYNCH

SIZE	CODE IDENT NO	DOCUMENT NO	REV
C	21793	401728	A

SCALE NONE SHEET 1 OF 2

6-33/6-34 Blank

Z15	Z9, 10
U7	
Q4	
P5	
C13	
HIGHEST	NOT USED
REF. DESIGNATIONS	

Z15	22K	3,4,5
Z12	22K	3,4,5
Z11	4.7K	4,5,6
Z8	330	4
Z7	330	4
Z6	470	6
Z5	470	2,3,5
Z4	330	2,3,5
Z3	470	4,5,6
Z2	470	2
Z1	470	6
U4C	10H107	12,13,14,15
U3D	10124	10,12,15
U3C	10124	11,13,14
REF DES	TYPE	PINS
UNUSED LOGIC NETWORKS		

U7	9687	11	3,14	6
U6	MCC2	10,29,31	11,21,30,35,40	1, 20
U4	10H107	------	1.16	8
U3	10124	9	16	8
U1.2.5	10116	------	1.16	8
REF. DES.	IC TYPE	+5V PIN.NO.	GND PIN.NO.	-5.2V PIN.NO.
IC POWER CONNECTIONS				

3. CAPACITOR VALUES ARE IN MICROFARIDS, ±10%, 100V UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS.
1. ALL RESISTOR NETWORKS ±2%.

NOTES UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC

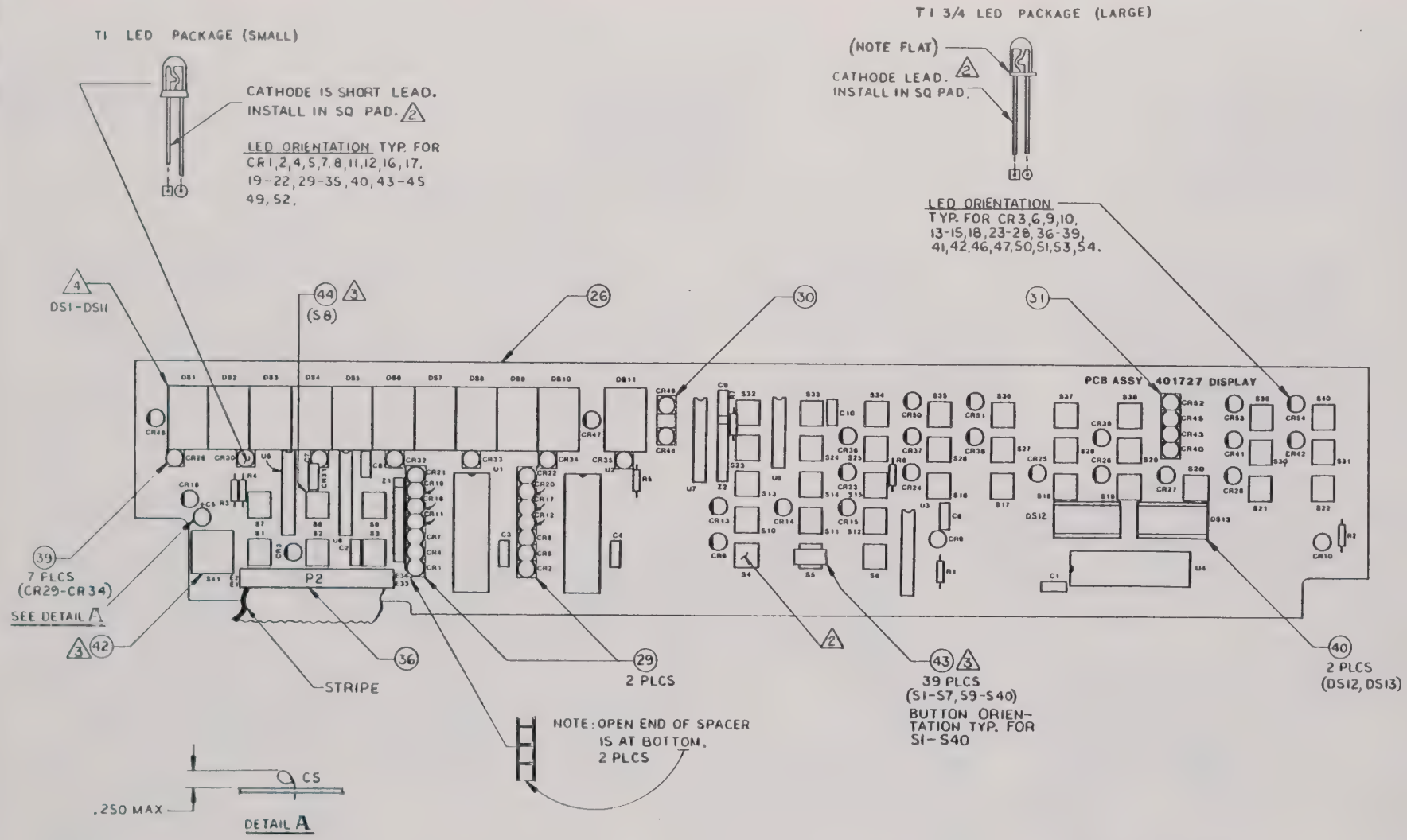
RACAL-DANA Instruments Inc.
4 GOODYEAR, IRVINE, CALIFORNIA 92714

DOCUMENT TITLE
SCHEM, MCC2 SYNCH.

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431728	A

SCALE —— SHEET 1 OF 1

DOC NO 431728



4 DS1-DS11 TO BE INSTALLED USING THE SAME INTENSITY CODE.

3 ENSURE BUTTON IS FIRMLY SEATED ON SWITCH.

2 INSTALL ALL LEDS (CR1-47, 49-54) AND SWITCHES (S1-41) FLUSH TO PCB.

1. REF. SCH. 431727.

NOTES UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE

THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED, ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT, WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL-DANA INSTRUMENTS INC BE USED, RELEASED OR DISCLOSED IN WHOLE OR IN PART, OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE, AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC

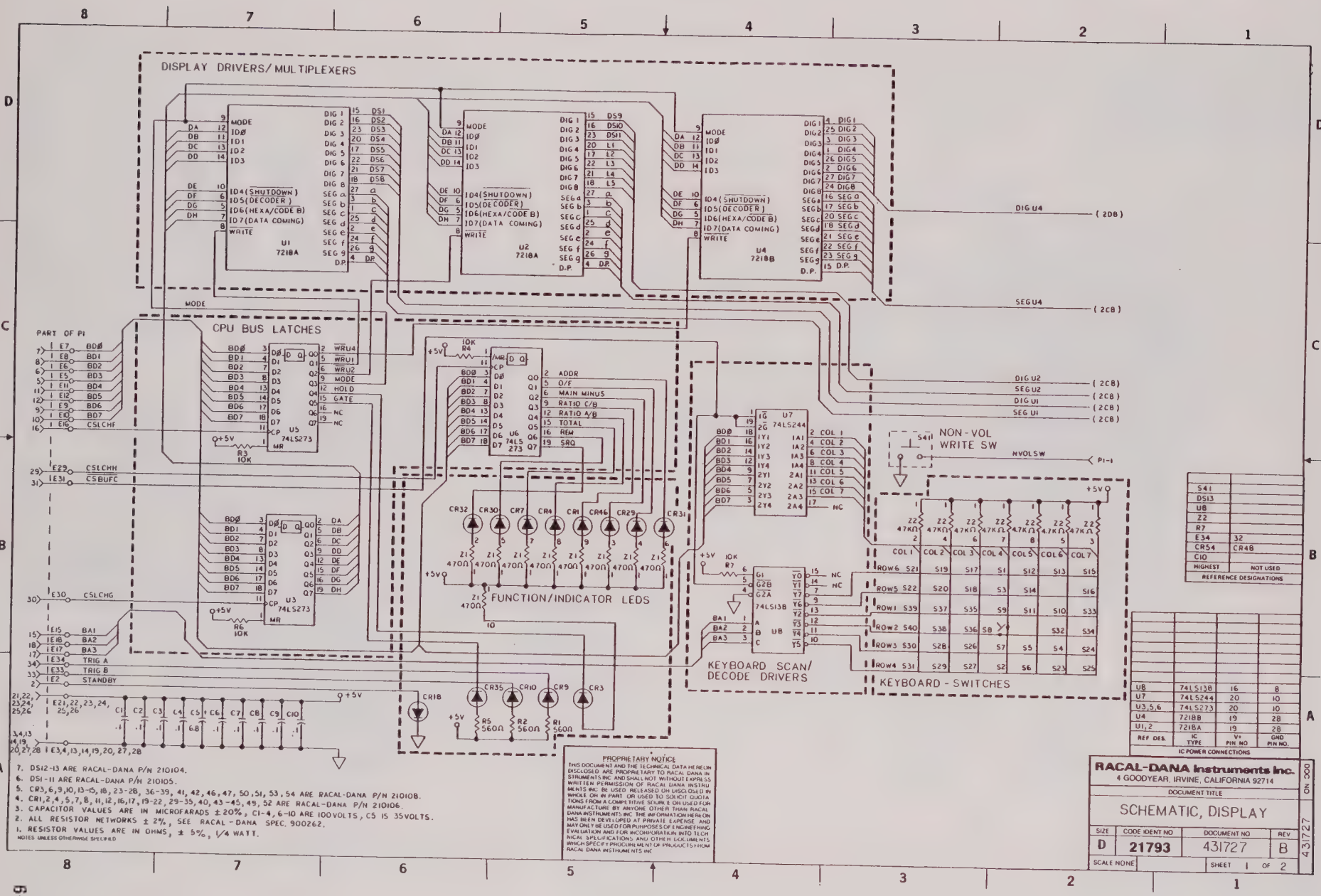
RACAL-DANA Instruments Inc.
4 GOODYEAR, IRVINE, CALIFORNIA 92714

DOCUMENT TITLE

PCB ASSY, DISPLAY

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	401727	E

SCALE NONE | SHEET 1 OF 3



S41	
DSI3	
U8	
Z2	
R7	
E34	32
CR54	CR48
C10	
HIGHEST	NOT USED

REFERENCE DESIGNATIONS

U8	74LS138	16	8
U7	74LS244	20	10
U3,5,6	74LS273	20	10
U4	7218B	19	28
U1,2	7218A	19	28
REF DES.	VC TYPE	V+ PIN NO	GND PIN NO.

IC POWER CONNECTIONS

7. DSI2-13 ARE RACAL-DANA P/N 210104.
6. DSI-11 ARE RACAL-DANA P/N 210105.
5. CR3, 6, 9, 10, 13-15, 18, 23-28, 36-39, 41, 42, 46, 47, 50, 51, 53, 54 ARE RACAL-DANA P/N 210108.
4. CR1, 2, 4, 5, 7, 8, 11, 12, 16, 17, 19-22, 29-35, 40, 43-45, 49, 52 ARE RACAL-DANA P/N 210106.
3. CAPACITOR VALUES ARE IN MICROFARADS ± 20%, C1-4, 6-10 ARE 100 VOLTS, C5 IS 35 VOLTS.
2. ALL RESISTOR NETWORKS ± 2%, SEE RACAL-DANA SPEC. 900262.
1. RESISTOR VALUES ARE IN OHMS, ± 5%, 1/4 WATT.

NOTES UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREIN DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC

RACAL-DANA Instruments Inc.
4 GOODYEAR, IRVINE, CALIFORNIA 92714

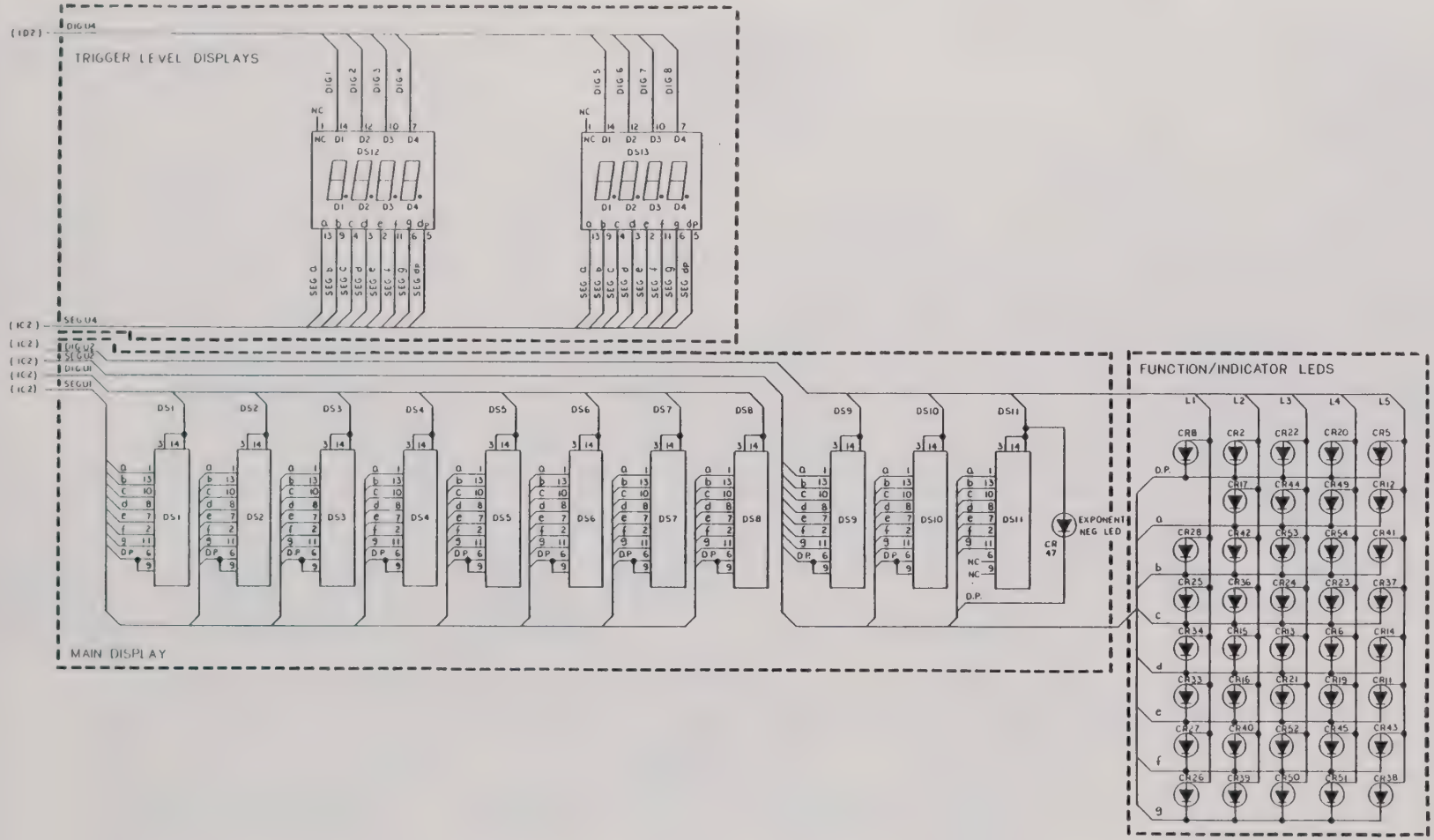
DOCUMENT TITLE
SCHEMATIC, DISPLAY

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431727	B

SCALE NONE | SHEET 1 OF 2

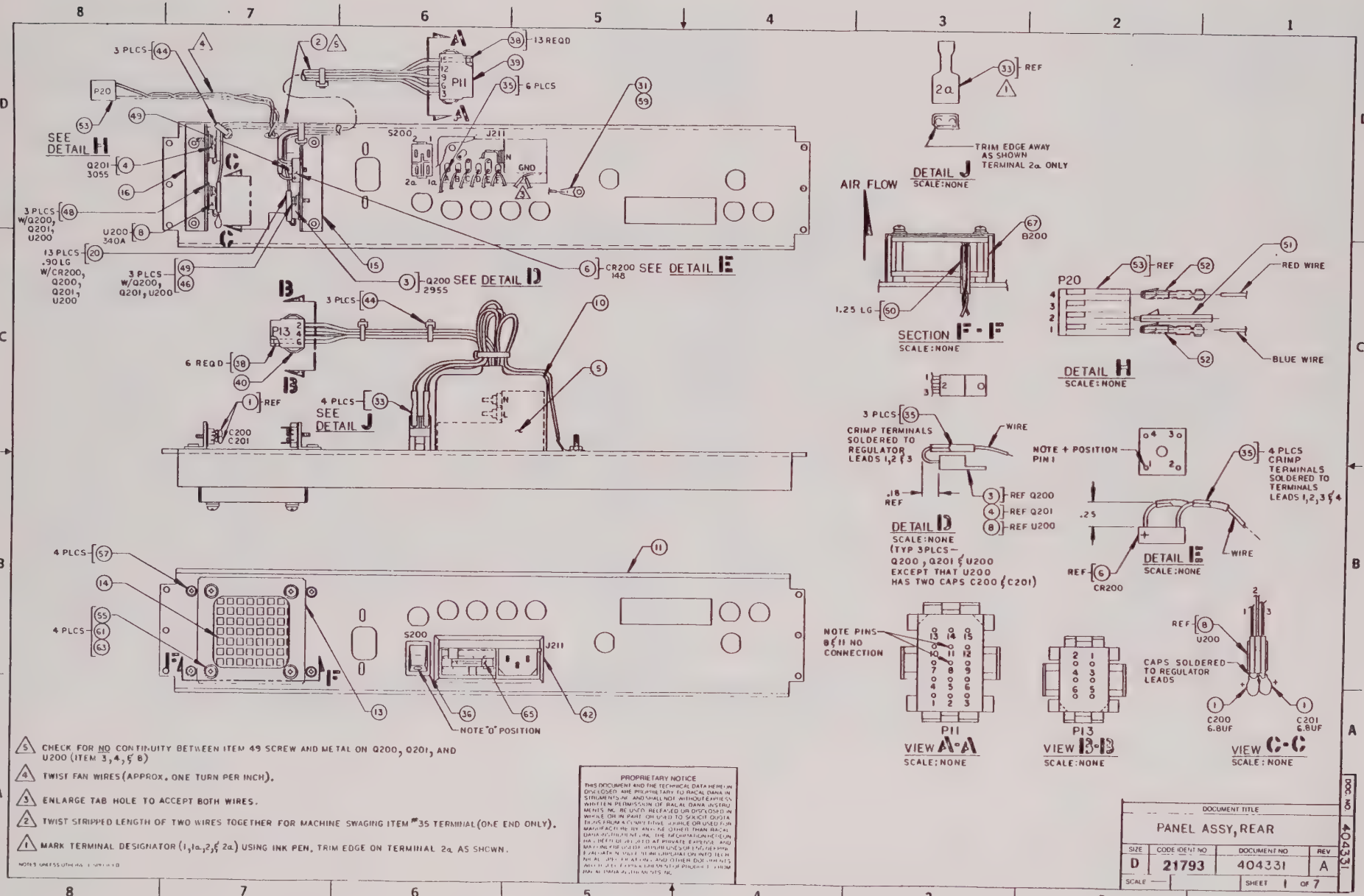
431727 ON 300

6-37



SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	431727	B
SCALE NONE		SHEET 2 OF 2	

DOC NO 431727



5 CHECK FOR NO CONTINUITY BETWEEN ITEM 49 SCREW AND METAL ON Q200, Q201, AND U200 (ITEM 3, 4, & 8)

4 TWIST FAN WIRES (APPROX. ONE TURN PER INCH).

3 ENLARGE TAB HOLE TO ACCEPT BOTH WIRES.

2 TWIST STRIPPED LENGTH OF TWO WIRES TOGETHER FOR MACHINE SWAGING ITEM #35 TERMINAL (ONE END ONLY).

1 MARK TERMINAL DESIGNATOR (1, 1a, 2, & 2a) USING INK PEN. TRIM EDGE ON TERMINAL 2a AS SHOWN.

NOTES UNLESS OTHERWISE SPECIFIED

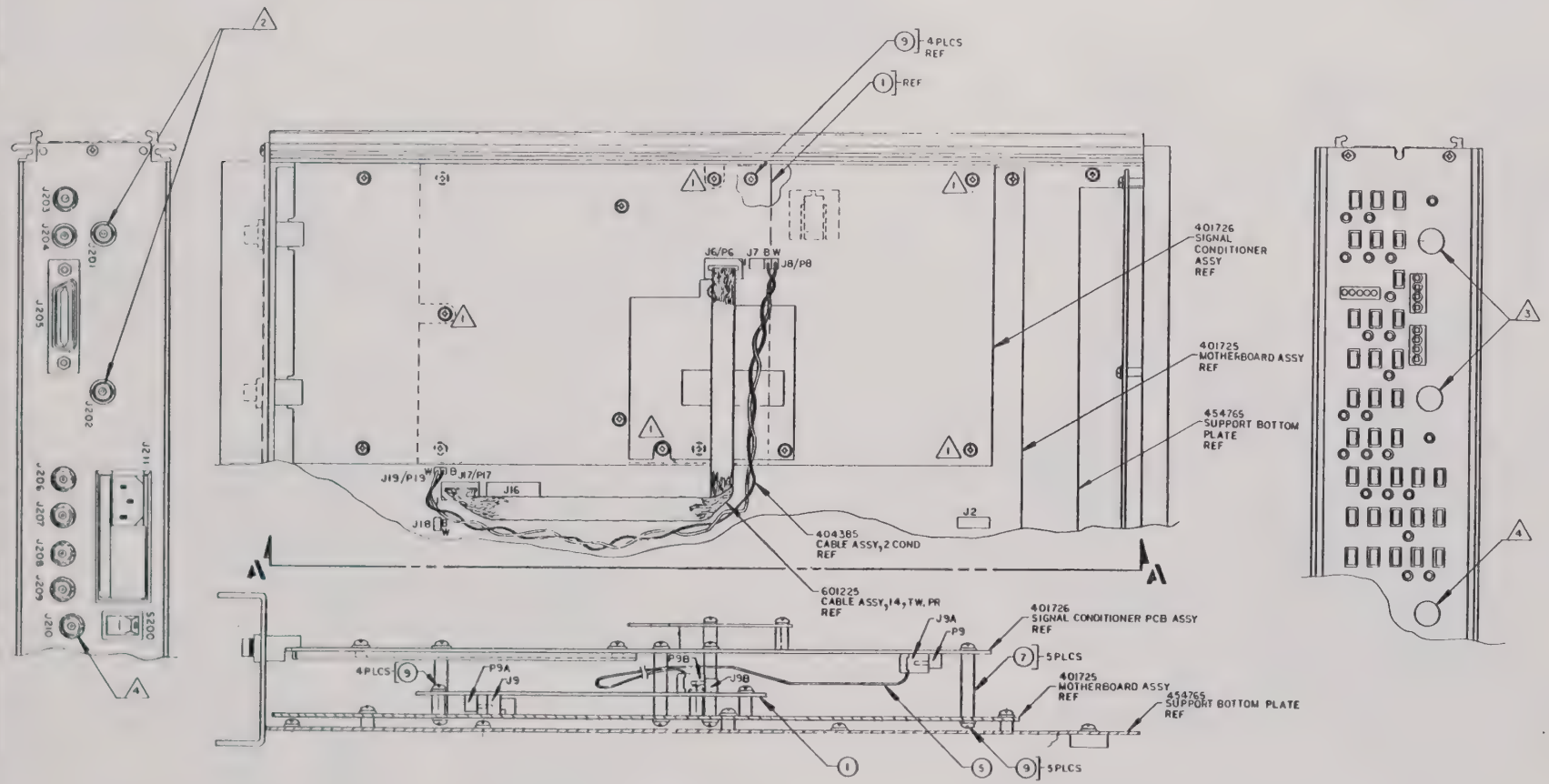
PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREIN DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC. AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC. BE USED, RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREON MAY NOT BE DISCLOSED AT PRIVATE EXPENSE AND MAY NOT BE USED WITHOUT EXPRESS WRITTEN EVALUATION WHICH IS TO BE DISPOSED OF UPON TECHNICAL EVALUATION AND OTHER DOCUMENTS AND DATA EXPRESSLY EXEMPT FROM RACAL DANA INSTRUMENTS INC.

DOCUMENT TITLE: PANEL ASSY, REAR

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	404331	A

SCALE — SHEET 1 OF 7

404331



SECTION A-A

4 REMOVE CHANNEL C BNC FROM FRONT PANEL AND INSTALL IN REAR PANEL. ROUTE CAPLE TO REAR PANEL (NO ATTACHMENTS REQD) MOVE HOLE PLUG FROM REAR PANEL TO FRONT PANEL. (REF. MODEL 1996 ONLY).

3 SHIFT PLASTIC PLUGS 61025I (SUPPLIED WITH TOP-LINE REF) FROM REAR PANEL TO RELATING HOLES IN FRONT PANEL. NOTE: ONLY APPLICABLE IF REAR INPUT IS INSTALLED AFTER OR DURING FINAL ASSY BUILD.

2 LOCK NUTS SUPPLIED WITH BNCS ON SIGNAL CONDITIONER.

1 SCREWS NOTED SUPPLIED WITH CHASSIS ASSY. WILL BE USED IN SAME POSITIONS ON SIGNAL CONDITIONER AS IN STD FRONT INPUT CONFIG.

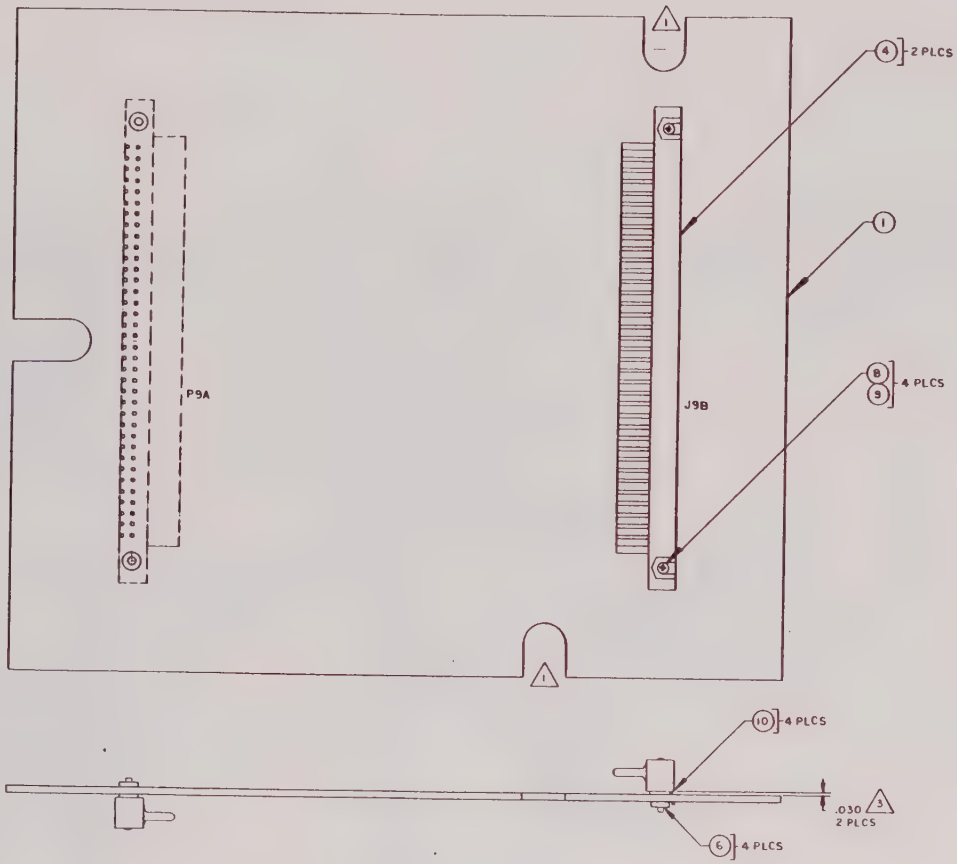
PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREIN DISCLOSED ARE PROPRIETARY TO NICOLET INSTRUMENTS INC. AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF NICOLET INSTRUMENTS INC. BE USED, REPRODUCED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SPECIFY OR DESIGN ANY EQUIPMENT OR PART FOR SALE OR MANUFACTURE BY ANYONE OTHER THAN NICOLET INSTRUMENTS INC. BY ACCEPTANCE OF THIS DOCUMENT THE RECIPIENT AGREES TO THE FOREGOING AND TO MAINTAIN ADEQUATE SECURITY AND CONTROL OVER ACCESS TO THIS DOCUMENT.

DOCUMENT TITLE: REAR INPUT ASSY, OPT. 01

SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	404378	A

SCALE 1:1 SHEET 1 OF 2

DOC NO 404378



3 MAINTAIN .030 CLEARANCE BETWEEN CONN. (ITEM 4) & PCB TYP

2. SCHEMATIC REF. 431752.

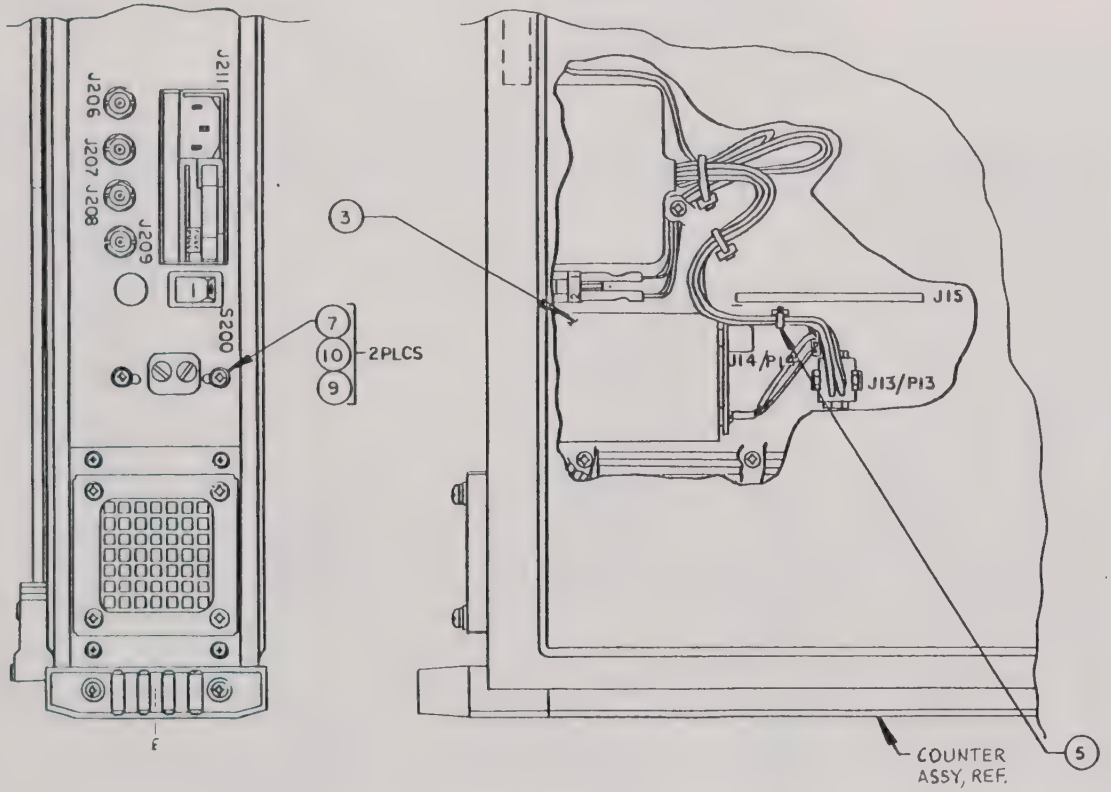
1 VERIFY ORIENTATION OF SLOTS PRIOR TO CONNECTOR INSTALLATION.

NOTES: UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC BE USED RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH EXPRESSLY CONFER SUCH RIGHTS ON RACAL DANA INSTRUMENTS INC

DOCUMENT TITLE			
PCB ASSY, REAR INPUT			
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	401752	B
SCALE 2/1		SHEET 1 OF 2	

DOC NO 401752



2. REMOVE THE FOLLOWING R/D PART NUMBERS: 10MHZ OSC. PCB ASSY(401730) ∮ SCREW PPH ~4-40X.312 ∮ WASHER (616252) 2PLCS.
1. REMOVE CABLE TIE (610777) SECURING CABLES TO J14/P14 AND J13/P13.

NOTES UNLESS OTHERWISE SPECIFIED

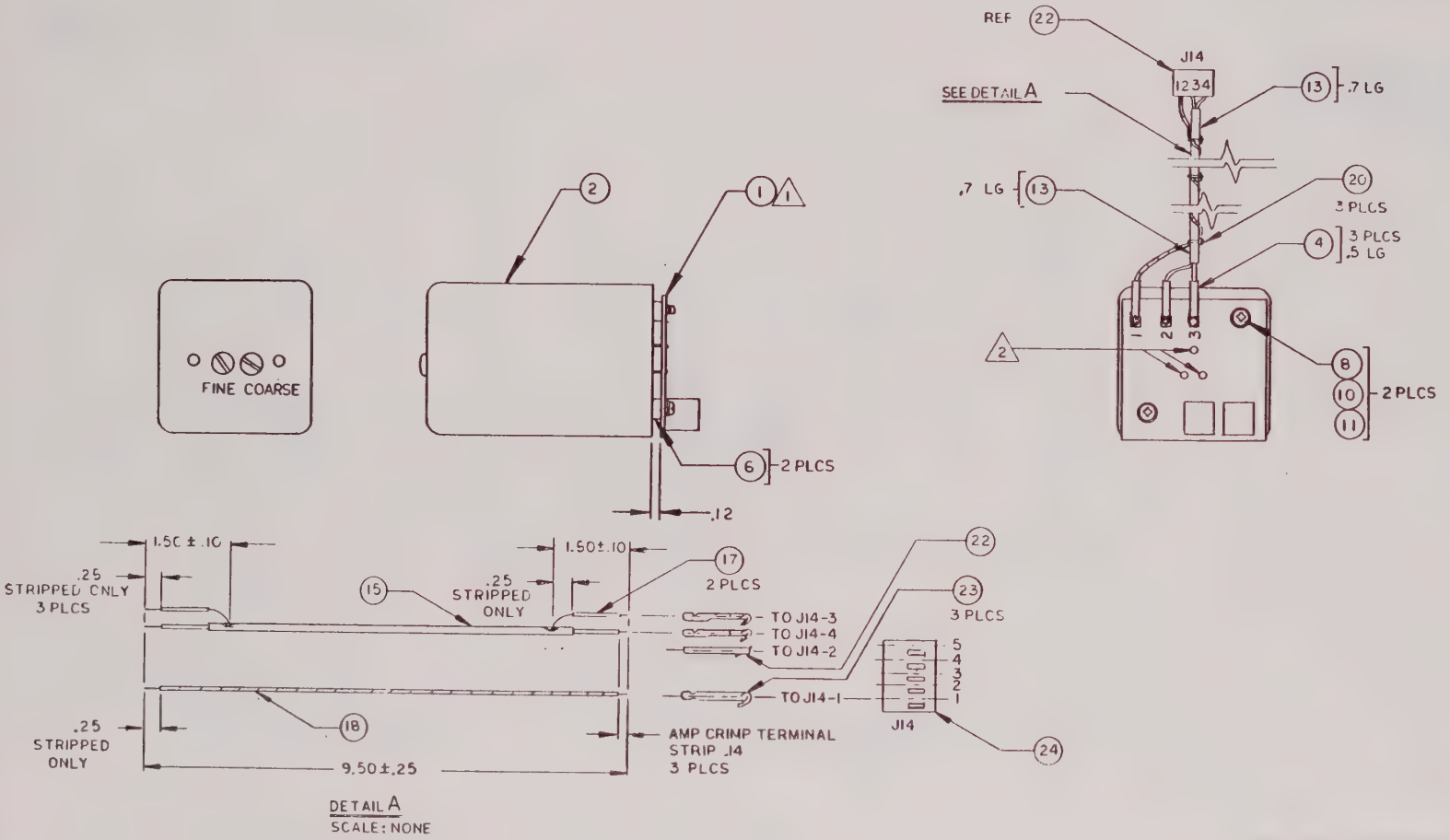
PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREIN DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC BE USED, RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREIN HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC

RACAL-DANA Instruments Inc.
4 GOODYEAR IRVINE, CALIFORNIA 92714

DOCUMENT TITLE
OSC ASSY, OPTION 04E

SIZE	CODE IDENT NO	DOCUMENT NO	REV
C	21793	404384	B

SCALE —— SHEET 1 OF 2



DETAIL A
SCALE: NONE

2. SOLDER AT ASSY.

1. REMOVE AND DISCARD CABLE SUPPLIED WITH ITEM 1 AND REPLACE WITH ITEMS: 4,13,15,17,18,20,22,23,24.

NOTES UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC. AND SHALL NOT, WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC. BE USED, RELEASED OR DISCLOSED IN WHOLE OR IN PART, OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREON HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY ONLY BE USED FOR PURPOSES OF ENGINEERING EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL DANA INSTRUMENTS INC.

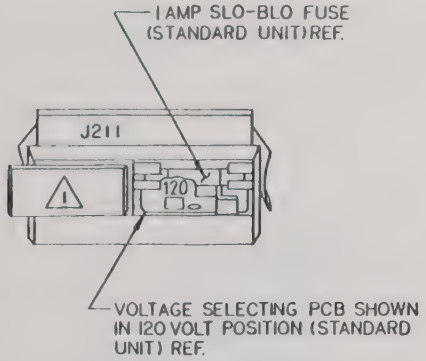
RACAL-DANA Instruments Inc.
4 GOODYEAR, IRVINE, CALIFORNIA 92714

DOCUMENT TITLE
OSCILLATOR ASSY

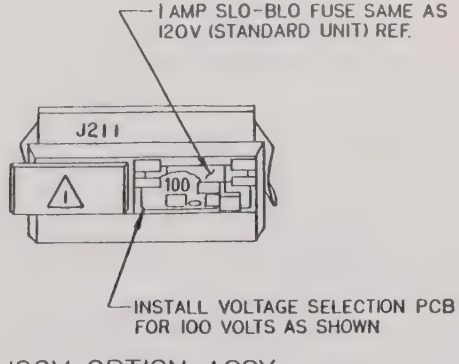
SIZE	CODE IDENT NO	DOCUMENT NO	REV
C	21793	404386	B

SCALE —— SHEET 1 OF 3

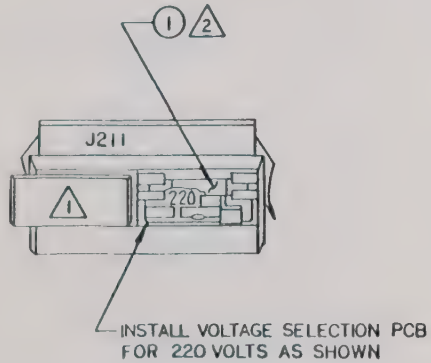
DOC NO 404386



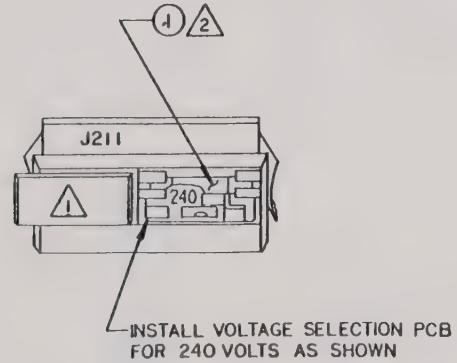
120V (STANDARD UNIT) REF.



100V OPTION ASSY



220V OPTION ASSY



240V OPTION ASSY

3. SERIAL NUMBER LABEL SHOULD BE MARKED AS REQUIRED TO SUIT SPECIFIC OPTION TO INDICATE CORRECT VOLTAGE.

2 REMOVE AND RETURN STANDARD FUSE TO STOCK.

1 FUSE AND PCB ACCESS COVER SHOWN IN OPEN POSITION.

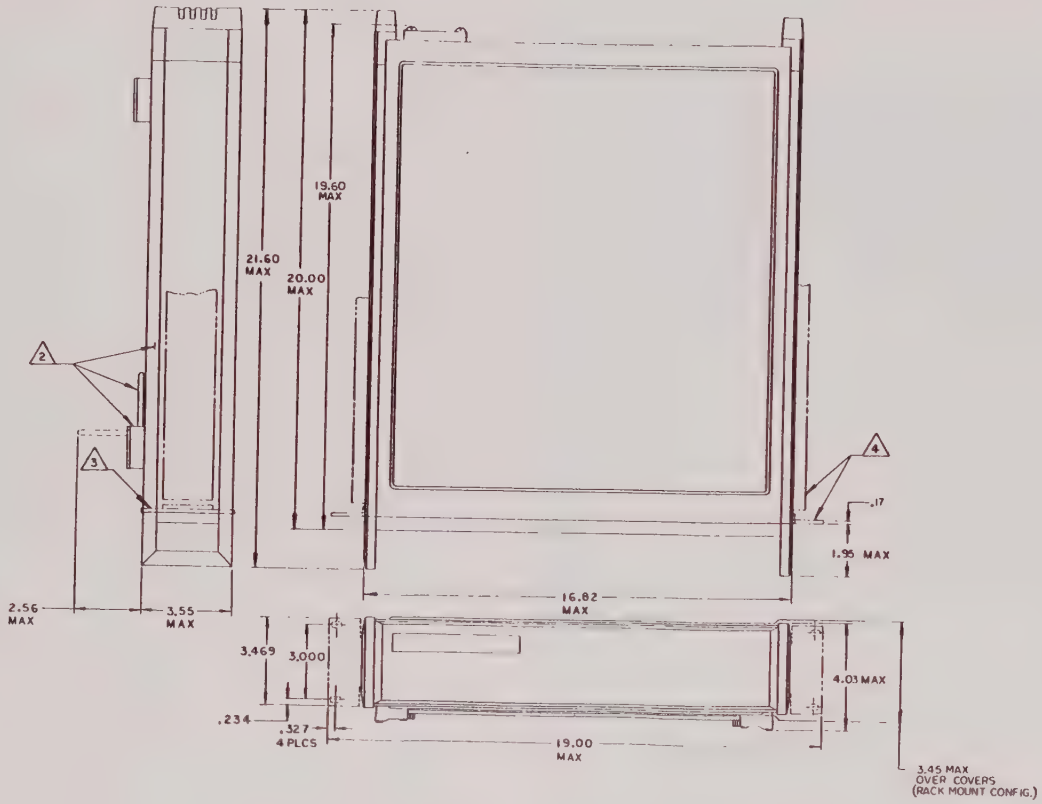
NOTES: UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE
THIS DOCUMENT AND THE TECHNICAL DATA HEREIN DISCLOSED ARE PROPRIETARY TO RACAL-DANA INSTRUMENTS, INC. AND SHALL NOT BE DISCLOSED, TRANSFERRED, REPRODUCED OR USED, IN WHOLE OR IN PART, OR USED TO SOLICIT QUOTATIONS FROM A COMPETITIVE SOURCE, OR USED FOR MANUFACTURING BY ANYONE OTHER THAN RACAL-DANA INSTRUMENTS, INC. THE INFORMATION HEREIN HAS BEEN DEVELOPED AT PRIVATE EXPENSE, AND MAY ONLY BE USED FOR PURPOSES OF OPERATION, MAINTENANCE, EVALUATION AND FOR INCORPORATION INTO TECHNICAL SPECIFICATIONS AND OTHER DOCUMENTS WHICH SPECIFY PROCUREMENT OF PRODUCTS FROM RACAL-DANA INSTRUMENTS, INC.

220V/240V OPERATION, OPTION 71

SIZE	CODE IDENT NO	DOCUMENT NO	REV
C	21793	404387	A

SCALE —— SHEET 1 OF 2



4. REFERENCE: SLIDE - RACK MOUNTING KIT 404183.

3. REFERENCE: RACK MOUNTING KIT 404180.

2. FEET, BAIL AND SIDE COVERS ARE REMOVED FOR RACK OR SLIDE INSTALLATION.

1. ALL DIMENSIONS FOR REFERENCE ONLY.

NOTES: UNLESS OTHERWISE SPECIFIED

PROPRIETARY NOTICE

THIS DOCUMENT AND THE TECHNICAL DATA HEREON DISCLOSED ARE PROPRIETARY TO RACAL DANA INSTRUMENTS INC AND SHALL NOT WITHOUT EXPRESS WRITTEN PERMISSION OF RACAL DANA INSTRUMENTS INC BE USED, RELEASED OR DISCLOSED IN WHOLE OR IN PART OR USED TO SOLICIT QUOTATION, DESIGN ALTERNATIVE SOURCE OR USED FOR MANUFACTURE BY ANYONE OTHER THAN RACAL DANA INSTRUMENTS INC. THE INFORMATION HEREIN HAS BEEN DEVELOPED AT PRIVATE EXPENSE AND MAY BE MADE AVAILABLE FOR LIMITED PURPOSES EVALUATION AND FOR INFORMATION AND USE IN NEAL OPERATION AND USE IN OUR FACILITIES WHEN EXPRESS AGREEMENT IS PRIOR TO RACAL DANA INSTRUMENTS INC.

DOCUMENT TITLE			
OUTLINE, DIMENSIONAL SERIES 1990			
SIZE	CODE IDENT NO	DOCUMENT NO	REV
D	21793	454847	A
SCALE		SHEET 1 OF 1	

DOC NO 454847

SECTION 7 PARTS LIST

7.1 This section contains lists of replaceable parts arranged in the order of the following subassemblies:

404335	Counter Assy, 1995	7-3
404336	Counter Assy, 1996	7-4
404332	Chassis Assy	7-5
401730	10 MHz Oscillator	7-5
19-1142	Channel C, 1996	7-6
401725	Motherboard	7-9
401726	Signal Conditioner	7-21
401728	AMCC2 Synch	7-29
401727	Display	7-31
404331	Rear Panel	7-34
401378	Option 01, Rear Input	7-36
401752	PCB Rear Input	7-36
404384	Opt 04E, Oscillator	7-37
404386	Oscillator Assy	7-37
404387	Opt 71, 220/240V Operation	7-37

7.2 Manufacturers are identified by FSC numbers listed in table 7.1, "List of Suppliers". The code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1, H4-2, and their supplements.

Table 7.1 - List of Suppliers

FSC	Name
00779	Amp, Inc. Harrisburg, PA
00853	Sangamo Electric Co. Pickens, SC
01295	Texas Instruments, Inc. Dallas, TX
02114	Ferroxcube Corp. Saugerties, NY
02735	RCA-Solid State Division Somerville, NJ
04713	Motorola, Inc. Semi-Conductor Division Phoenix, AZ
05245	Corcom, Inc. Chicago, IL
05397	Union Carbide Corp. Material Systems Division Cleveland, OH
05972	Loctite Corp. Hartford, CT
06540	Amatom Electronic Hardware New Rochelle, NY
06776	Robinson Nugent, Inc. New Albany, IN
07263	Fairchild Semi-Conductor Division Mountain View, CA
11236	CTS of Berne, Inc. Berne, IN
11532	Teledyne Northridge, CA
12969	Unitrode Corp. Watertown, MA

FSC	Name
13103	Thermalloy, Inc. Dallas, TX
14908	Electronic Instrument & Specialty Corp. Stoneham, MA
14949	Trompeter Electronics Chatsworth, CA
15636	Elec-Trol, Inc. Saugus, CA
17856	Siliconix, Inc. Santa Clara, CA
18324	Signetics Corp. Sunnyvale, CA
18565	Chromerics, Inc. Woburn, MA
19505	Applied Engineering Products New Haven, CT
19647	Caddock Riverside, CA
19738	Avdel-Chobert Teleboro, NJ
21317	Electronic Applications Co. So. El Monte, CA
21793	Racal-Dana Instruments Inc. Irvine, CA
24355	Analog Devices Norwood, MA
25088	Siemens Corp. Components Group Iselin, NJ
27014	National Semi-Conductor Corp. Santa Clara, CA
27264	Molex Products Co. Downers Grove, IL

FSC	Name
27777	Varo Electran Devices, Inc. Garland, TX
28520	Heyco Kenilworth, NJ
29005	Storm Products Los Angeles, CA
31918	ITT Schadow, Inc. Eden Prarie, MN
32293	Intersil, Inc. Cupertino, CA
32559	Bivar, Inc. Santa Ana, CA
32997	Bourns Trimpot Products Division Riverside, CA
34785	Dek-Inc. St. Charles, IL
46384	Penn Engineering & Mfg. Corp. Doylestown, PA
50434	Hewlett-Packard Co. HPA Division Palo Alto, CA
50579	Litronix, Inc. Cupertino, CA
52072	Circuit Assembly Corp. Costa Mesa, CA
52648	Plessey Memories Santa Ana, CA
53421	Tyton Corp. Milwaukee, WI
54473	Matsushita Electric Co. Secaucus, NJ
55167	Corona Magnetics Corona, CA
52531	Hitachi Magnetics Corp. Edmore, MI

FSC	Name
55322	Samtec, Inc. New Albany, IN
55411	California Crystal Inc. Anaheim, CA
56289	Sprague Electric Co. Pacific Division Los Angeles, CA
57856	Kel-Am Inc. Eldon, MO
59311	Communication Instruments El Segundo, CA
61394	Seeq Technology San Jose, CA
70903	Beldon Corp. Chicago, IL
71590	Centralab Electronics Milwaukee, WI
71707	Coto-Coil Co., Inc. Providence, RI
71785	TRW Electronic Components Cinch Division Elk Grove, IL
72136	Electro motive Mfg. Co., Inc. Willimantic, CT
72982	Erie Technological Products, Inc. Erie, PA
75915	Littelfuse, Inc. Des Plaines, IL
76493	J. W. Miller Co. Compton, CA
78189	Illinois Tool Works, Inc. Shakeproof Division Elgin, IL
79963	Zierick Mfg. Corp. New Rochelle, NY

FSC	Name
80031	Mepco-Electra Morristown, NJ
80131	Electronics Industries Associates Washington, DC
81349	Military Specification
83330	Herman H. Smith, Inc. Brooklyn, NY
86928	Seastrom Mfg. Co. Glendale, CA
88245	Litton Precision Products Van Nuys, CA
91506	Augut, Inc. Attleboro, MA

FSC	Name
91637	Dale Electronics, Inc. Columbus, NE
95987	Weckesser Co., Inc. Chicago, IL
98291	Sealectro Corp. Mamaroneck, NY
NOTE 1	RPM Enterprises Santa Ana, CA
NOTE 2	Res-Net Corp. Whippany, NJ
NOTE 3	Universal Components Co. Marquardt Products Los Angeles, CA

404335-COUNTER ASSY., MODEL 1995 B

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
1	404293	COVER ASSY., BOTTOM	21793	404293
2	401730	PCB ASSY., 10 MHZ, OSCILLATOR	21793	401730
3	404332	CHASSIS ASSY	21793	404332
4	454319	FOOT REAR (2 REQ'D)	21793	404319
6	454344	PANEL, SIDE COVER (2 REQ'D)	21793	454344
7	454352	PANEL, TOP COVER	21793	454352
9	454393	HANDLE ASSY (2 REQ'D)	21793	454393
11	454768	BUMPER, REAR FOOT (2 REQ'D)	21793	454768
12	454769	OVERLAY, FRONT PANEL	21793	454769
13	454770	OVERLAY, REAR PANEL	21793	454770
14	610777	CABLE TIE	53421	T18R
15	600620	CABLE, POWER AC LINE	70903	KHS-7041
16	610231	BUTTON PLUG, PLASTIC (4 REQ'D)	28520	P-500
17	610379	WASHER, FLAT, #4, NYLON (4 REQ'D)	95987	NW4-2812
18	616252	SCREW, PPH, SEMS ASSY (2 REQ'D)	21793	616252
19	615073	SCREW, PPH, 8-32 X .312 (4 REQ'D)	——	——
20	610925	SCREW, PPH, 6-32 X 1.00 (4 REQ'D)	78189	——
21	611026	NUT, HEX, 112-28 (6 REQ'D)	00779	1-329631-2
22	611027	WASHER, LOCK, INT, 112 (6 REQ'D)	00779	1-329632-2
23	616255	SCREW, PPH, SEMS ASSY., 6-32 X .312 (7 REQ'D)	78189	——
24	920888	LABEL, IDENTIFICATION	21793	920888
25	980599	MANUAL, INSTRUCTION	21793	980599

404336-COUNTER ASSY., MODEL 1996 B

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
1	404293	COVER ASSY., BOTTOM	21793	404293
2	401730	PCB ASSY., 10 MHZ, OSCILLATOR	21793	401730
3	404332	CHASSIS ASSY	21793	404332
4	454319	FOOT REAR (2 REQ'D)	21793	404319
6	454344	PANEL, SIDE COVER (2 REQ'D)	21793	454344
7	454352	PANEL, TOP COVER	21793	454352
9	454393	HANDLE ASSY (2 REQ'D)	21793	454393
11	454768	BUMPER, REAR FOOT (2 REQ'D)	21793	454768
12	454769	OVERLAY, FRONT PANEL	21793	454769
13	454770	OVERLAY, REAR PANEL	21793	454770
14	610777	CABLE TIE	53421	T18R
15	600620	CABLE, POWER AC LINE	70903	KHS-7041
16	610231	BUTTON PLUG, PLASTIC (4 REQ'D)	28520	P-500
17	610379	WASHER, FLAT, #4, NYLON (4 REQ'D)	95987	NW4-2812
18	616252	SCREW, PPH, SEMS ASSY (2 REQ'D)	21793	616252
19	615073	SCREW, PPH, 8-32 X .312 (4 REQ'D)	——	——
20	610925	SCREW, PPH, 6-32 X 1.00 (4 REQ'D)	78189	——
21	611026	NUT, HEX, 112-28 (6 REQ'D)	00779	1-329631-2
22	611027	WASHER, LCOK, INT, 112 (6 REQ'D)	00779	1-329632-2
23	616255	SCREW, PPH, SEMS ASSY., 6-32 X .312 (7 REQ'D)	78189	——
24	920888	LABEL, IDENTIFICATION	21793	920888
25	980599	MANUAL, INSTRUCTION	21793	980599
26	404389	PCB ASSY., CHANNEL C	21793	404389
27	404387	CABLE ASSY., 2 COND.	21793	404387

404336-COUNTER ASSY., MODEL 1996 (CONT'D) B

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
28	454868	BRACKET, SUPPORT, CH. C (2 REQ'D)	21793	454868
30	601235	CONNECTOR, BNC, PNL, MTG (J103)	21793	601235
32	610127	WASHER, SHOULDER, #4, NYLON (2 REQ'D)	86928	5607-10
33	610198	WASHER, FLAT, #4, NYLON (2 REQ'D)	86928	5610-10-31
35	611066	SCREW, METRIC, M3X6 (2 REQ'D)	——	——
38	617127	WASHER, LOCK, #4, LIGHT SERIES (2 REQ'D)	——	——

404332 - ASSY., CHASSIS D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
1	401725	PCB ASSY., MOTHERBOARD	21793	401725
2	401726	PCB ASSY., SIGNAL COND.	21793	401726
3	401727	PCB ASSY., DISPLAY KEYBOARD	21793	401727
9	192552	FASTENER, LOCK, 14-PIN DIP (2 REQ'D)	52072	CA-14-200-DL
5	404330	ASSY., TRANSFORMER	21793	404330
6	404331	ASSY., REAR PANEL	21793	404331
8	454372	PUSH ROD	21793	454372
10	454390	BLOCK MOUNTING (8 REQ'D)	21793	454390
12	454763	PANEL, FRONT	21793	454763
13	454764	PANEL, SIDE, RIGHT	21793	454764
14	454763	PLATE, SUPPORT, BOTTOM	21793	454736
18	454818	PANEL, SIDE, LEFT	21793	454818
19	454819	SHIELD, SIG. COND., BTM	21793	454819
21	500213-011	TUBING, TYGON, 1.0 LG	21793	500231-011
23	404385	CABLE ASSY., 2 COND.	21793	404385
24	601225	CABLE ASSY., 14, TWIST PR	52072	CA-D14P02-284-IT-010
26	610909	SCREW, PPH, TAPTITE, 6-32 X .500 (6 REQ'D)	78189	——
30	611075	CLAMP, CLUTCH-TYPE	78553	C40588-020-1
37	616252	SCREW, PPH, SEMS ASSY., 4-40 X .312 (11 REQ'D)	78189	——
38	616255	SCREW, PPH, SEMS ASSY., 6-32 X .312 (9 REQ'D)	78189	——
40	616259	SCREW, PPH, SEMS ASSY., 8-32 X .312 (4 REQ'D)	78189	——
44	921006	BUTTON, PUSH, PWR, RED	21793	921006

401730 - PCB ASSY., 10 MHZ OSCILLATOR A

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
P14	611056	CONNECTOR, CABLE, 5 PIN	00779	530554-4
Y1	921013	OSCILLATOR, 10 MHZ	21793	921013
1	411730	PCB, 10 MHZ OSCILLATOR (UNLOADED)	21793	411730
4	524211	WIRE, TEFLON, STRANDED, 24 GA, BRN/RED	——	——
5	524333	WIRE, TEFLON, STRANDED, 24 GA, ORG	——	——
6	524555	WIRE, TEFLON, STRANDED, 24 GA, GRN	——	——
8	610160	STANDOFF, 4-40, THRU SWAGE (2 REQ'D)	83330	4103
10	610777	CABLE TIE	53421	18TR
12	611052	KEY, POLARIZING, PLUG	00779	87077-1
13	611053	TERMINAL, CRIMP (4 REQ'D)	00779	530553-2

19-1142, CHANNEL "C" ASSY, 1.3 GHZ 2

REF. DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C1	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C2	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C3	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C4	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C5	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C6	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C7	21-1781	CAP, CHIP, 3.3 PF	95275	VJ1206A3R3CF
C8	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C9	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C10	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C11	21-1781	CAP, CHIP, 3.3 PF	95275	VJ1206A3R3CF
C12	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C13	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C14	21-1781	CAP, CHIP, 3.3 PF	95275	VJ1206A3R3CF
C15	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C16	21-0795	CAP, 47 UF	54473	ECEA1HK2R2E
C17	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C18	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C19	21-1779	CAP, CHIP, 2.2 PF	95275	VJ1206A2R2CF
C20	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C21	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C22	21-1781	CAP, CHIP, 3.3 PF	95275	VJ1206A3R3CF
C23	21-1788	CAP, CHIP, 12 PF	95275	VJ1206A120JF
C24	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF

19-1142, CHANNEL "C" ASSY, 1.3 GHZ (CONT'D) 2

REF. DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C25	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C26	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C27	21-0795	CAP, 47 UF	54473	ECEA1HK2R2E
C28	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C29	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C30	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C31	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C32	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C33	21-1781	CAP, CHIP, 3.3 PF	95275	VJ1206A120JF
C34	21-1785	CAP, CHIP, 6.8 PF	95275	VJ1206A6R8CF
C35	21-1785	CAP, CHIP, 6.8 PF	95275	VJ1206A6R8CF
C36	21-1785	CAP, CHIP, 6.8 PF	95275	VJ1206A6R8CF
C37	20-1795	CAP, CHIP, 47 PF	95275	VJ1206A470JF
C38	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C39	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C40	21-1781	CAP, CHIP, 3.3 PF	95275	VJ1206A3R3CF
C41	21-1781	CAP, CHIP, 3.3 PF	95275	VJ1206A3R3CF
C42	21-1781	CAP, CHIP, 3.3 PF	95275	VJ1206A3R3CF
C43	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C44	21-0795	CAP, 47 UF	54473	ECEA1HK2R2E
C45	21-0795	CAP, 47 UF	54473	ECEA1HK2R2E
C46	21-1775	CAP, CHIP, 1 PF	95275	VJ1206A1R0CF
C47	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF
C48	21-1801	CAP, CHIP, 10 NF	95275	VJ1206Y103MF

19-1142, CHANNEL "C" ASSY, 1.3 GHZ (CONT'D) 2

REF. DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
D1	22-1086	DIODE, SILICO	50434	5082-2835
D2	22-1058	DIODE, SILICO	50434	5082-3379
D3	22-1086	DIODE, SILICO	50434	5082-2835
D5	22-1086	DIODE, SILICO	50434	5082-2835
D6	22-1086	DIODE, SILICO	50434	5082-2835
D7	22-1058	DIODE, SILICO	50434	5082-3379
D8	22-1068	DIODE, SILICO	50434	5082-2800
D9	22-1068	DIODE, SILICO	50434	5082-2800
D10	22-1814	DIODE, ZENER	71468	BZX79C9V1
D11	22-1814	DIODE, ZENER	71468	BZX79C9V1
D12	22-1029	DIODE, SILICO	01295	1N4149
D13	22-1086	DIODE, SILICO	50434	5082-2835
D14	22-1086	DIODE, SILICO	50434	5082-2835
D15	22-1086	DIODE, SILICO	50434	5082-2835
D16	22-1086	DIODE, SILICO	50434	5082-2835
IC1	22-4249	IC	27014	LM339
IC2	22-4528	IC	04713	MC10116
IC3	22-4687	IC	52648	SP4632
IC4	22-4531	IC	01295	74LS00
L1	17-3240	COIL ASSY	21793	17-3240
L2	17-3240	COIL ASSY	21793	17-3240
L3	17-3240	COIL ASSY	21793	17-3240
L4	17-3240	COIL ASSY	21793	17-3240

19-1142, CHANNEL "C" ASSY, 1.3 GHZ (CONT'D) 2

REF. DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
Q1	22-6123	TRANSISTOR	18324	BFR90
Q2	22-6123	TRANSISTOR	18324	BFR90
Q3	22-6123	TRANSISTOR	18324	BFR90
Q4	22-6155	TRANSISTOR	50434	HXTR3101
R3	20-5768	RES, CHIP, 10K	18324	RC-01
R4	20-5768	RES, CHIP, 10K	18324	RC-01
R5	20-5841	RES, CHIP, 150 OHM, 1W	21793	20-5841
R6	20-5837	RES, CHIP, 39 OHM, 1W	21793	20-5837
R7	20-5787	RES, CHIP, 330 OHM	18324	RC-01
R8	20-5783	RES, CHIP, 150 OHM	18324	RC-01
R10	20-5764	RES, CHIP, 100 OHM	18324	RC-01
R12	20-5771	RES, CHIP, 10 OHM	18324	RC-01
R13	20-5775	RES, CHIP, 27 OHM	18324	RC-01
R14	20-5788	RES, CHIP, 390 OHM	18324	RC-01
R16	20-5783	RES, CHIP, 150 OHM	18324	RC-01
R18	20-5771	RES, CHIP, 10 OHM	18324	RC-01
R19	20-5775	RES, CHIP, 27 OHM	18324	RC-01
R20	20-5787	RES, CHIP, 330 OHM	18324	RC-01
R23	20-5783	RES, CHIP, 150 OHM	18324	RC-01
R24	20-5771	RES, CHIP, 10 OHM	18324	RC-01
R25	20-5775	RES, CHIP, 27 OHM	18324	RC-01
R26	20-5785	RES, CHIP, 220 OHM	18324	RC-01
R27	20-7049	POT, 20K	21793	72XL

19-1142, CHANNEL "C" ASSY, 1.3 GHZ (CONT'D) 2

REF. DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
R28	20-5783	RES, CHIP, 150 OHM	18324	RC-01
R29	20-5813	RES, CHIP, 100K	18324	RC-01
R30	20-5771	RES, CHIP, 10 OHM	18324	RC-01
R31	20-5773	RES, CHIP, 15 OHM	18324	RC-01
R32	20-5783	RES, CHIP, 150 OHM	18324	RC-01
R33	20-5794	RES, CHIP, 1.5K	18324	RC-01
R34	20-5794	RES, CHIP, 1.5K	18324	RC-01
R35	20-5810	RES, CHIP, 56K	18324	RC-01
R36	20-5764	RES, CHIP, 100 OHM	18324	RC-01
R37	20-5796	RES, CHIP, 2.2K	18324	RC-01
R38	20-5810	RES, CHIP, 56K	18324	RC-01
R39	20-5770	RES, CHIP, 1M	18324	RC-01
R41	20-5799	RES, CHIP, 4.7K	18324	RC-01
R42	20-5799	RES, CHIP, 4.7K	18324	RC-01
R44	20-5792	RES, CHIP, 1K	18324	RC-01
R45	20-5783	RES, CHIP, 150 OHM	18324	RC-01
R46	20-5775	RES, CHIP, 27 OHM	18324	RC-01
R47	20-5775	RES, CHIP, 27 OHM	18324	RC-01
R48	20-5775	RES, CHIP, 27 OHM	18324	RC-01
R49	20-5775	RES, CHIP, 27 OHM	18324	RC-01
R50	20-5796	RES, CHIP, 2.2K	18324	RC-01
R52	20-5801	RES, CHIP, 6.8K	18324	RC-01
R53	20-5797	RES, CHIP, 3.3K	18324	RC-01
R54	20-5792	RES, CHIP, 1K	18324	RC-01

19-1142, CHANNEL "C" ASSY, 1.3 GHZ (CONT'D) 2

REF. DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
R55	20-5792	RES, CHIP, 1K	18324	RC-01
R56	20-5790	RES, CHIP, 680 OHM	18324	RC-01
R57	20-5766	RES, CHIP, 2.7K	18324	RC-01
R58	20-5797	RES, CHIP, 3.3K	18324	RC-01
R59	20-5792	RES, CHIP, 1K	18324	RC-01
R60	20-5792	RES, CHIP, 1K	18324	RC-01
R61	20-5792	RES, CHIP, 1K	18324	RC-01
R62	20-5792	RES, CHIP, 1K	18324	RC-01
R66	20-5764	RES, CHIP, 100 OHM	18324	RC-01
R68	20-5770	RES, CHIP, 1M	18324	RC-01
R69	20-5770	RES, CHIP, 1M	18324	RC-01
R70	20-5771	RES, CHIP, 10 OHM	18324	RC-01
R71	20-5771	RES, CHIP, 10 OHM	18324	RC-01
SK7	23-5173	CONNECTOR, 30 WAY	21793	23-5173

401725 - PCB ASSY., MOTHERBOARD J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C2	110215	CAP, TANTA, 1.5 MFD, 25V, 10%	80031	41GS155A025K1A
C3	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C4	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C5	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C6	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C7	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C8	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C9	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C10	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C11	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C12	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C13	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-013K
C14	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C15	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C16	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C17	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C18	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C19	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C20	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C21	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C22	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C23	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C24	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C25	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C26	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C27	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C28	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C29	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C30	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C31	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C32	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C33	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C34	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C35	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C36	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C37	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C38	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C39	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C40	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C41	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C42	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C43	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C44	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C45	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C46	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C47	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C48	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C49	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C50	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C51	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C52	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C53	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C54	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C55	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C56	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C57	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C58	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C59	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C60	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C61	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C62	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C63	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C64	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C65	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C66	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C67	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C68	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C69	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C70	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C71	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C72	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C73	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C74	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C75	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C76	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100W5R0-103K
C77	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C78	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C79	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C80	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C81	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C82	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C83	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C84	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C85	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C86	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C87	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C88	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C89	110218	CAP, TANTA, 47 MFD, 20V, 20%	56289	199D476X0020EE2
C90	110218	CAP, TANTA, 47 MFD, 20V, 20%	56289	199D476X0020EE2
C91	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C92	110217	CAP, AE, 1000 MFD, 35V, RADIAL	80031	347SKG102M035TMBS
C93	110217	CAP, AE, 1000 MFD, 35V, RADIAL	80031	347SKG102M035TMBS
C94	110214	CAP, AE, 10000 MFD, 16V	00853	380-103-P-16-J04
C95	110214	CAP, AE, 10000 MFD, 16V	00853	380-103-P-16-J04
C96	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C97	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C98	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C99	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C100	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C101	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C102	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C103	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C104	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C105	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C106	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C107	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C108	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C109	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C110	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C111	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C112	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C113	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C114	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C115	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C116	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C117	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C118	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C119	110219	CAP, AE, 3300 MFD, 16V, 20%	80031	3476KL332M016
C120	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C121	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C122	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C123	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C124	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C125	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C126	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C127	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C128	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C129	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C130	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C131	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C132	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C133	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C134	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C135	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C136	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C137	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C138	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C139	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C140	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C141	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C142	130171	CAP, TRIMMER, CERAM, 5-25 PFD, 250V	56289	GKU25000
C143	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C144	100065	CAP, CERAM, .0022 MFD, 1000V, 10%	71590	DD222
C145	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C146	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C147	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C148	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C149	130094	CAP, MICA, 220 PFD, 500V, 5%	72136	SCDM10-221J
C150	130094	CAP, MICA, 220 PFD, 500V, 5%	72136	SCDM10-221J
C151	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C152	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C153	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C154	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C155	100106	CAP, CERAM, 100 PFD, 1000V, 10%	56289	10-TS-T10
C156	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C157	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C158	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C159	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C160	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C161	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C162	100116	CAP, CERAM, 500 PFD, 1000V, 20%	56289	C0238102E501M
C163	100142	CAP, CERAM, 82 PFD, 100V, 5%	05397	C320C820J1G5CA
C164	100071	CAP, CERAM, .001 MFD, 1000V, 20%	56289	C0238102E102M
C165	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C166	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C167	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C168	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C169	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C170	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C171	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C172	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C173	100116	CAP, CERAM, 500 PFD, 1000V, 20%	56289	C0238102E501M
C174	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C175	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C176	100124	CAP, CERAM, 330 PFD, 1KV, 20%	56289	C023B102E331M
C177	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C178	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C179	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C180	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C181	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
CR1	230551	IC, VOLTAGE REFERENCE	24355	AD589JH
CR2	211083	DIODE, SILICO	81349	1N916B
CR3	220095	DIODE, ZENER, DUAL, 18V	SEE NOTE 1 TABLE 7.1	DM503CC100SP
CR4	220100	DIODE ARRAY, 11 ZENERS, SIP, 6.2V	SEE NOTE 1 TABLE 7.1	DM512CC100SP
CR5	210004	DIODE, SILICO	81349	1N4004
CR6	210004	DIODE, SILICO	81349	1N4004
CR7	211083	DIODE, SILICO	81349	1N916B
CR8	230594	IC, FULL WAVE RECT. BRIDGE	27777	VH148
CR9	210004	DIODE, SILICO	81349	1N4004
CR10	210004	DIODE, SILICO	81349	1N4004
CR11	210004	DIODE, SILICO	81349	1N4004
CR12	211083	DIODE, SILICO	81349	1N916B
CR13	211083	DIODE, SILICO	81349	1N916B

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
CR14	211083	DIODE, SILICO	81349	1N916B
CR15	211083	DIODE, SILICO	81349	1N916B
CR16	211083	DIODE, SILICO	81349	1N916B
CR17	211083	DIODE, SILICO	81349	1N916B
CR18	211083	DIODE, SILICO	81349	1N916B
CR19	211083	DIODE, SILICO	81349	1N916B
CR20	210004	DIODE, SILICO	81349	1N4004
CR21	210102	DIODE, VARACTOR, SILICO	04713	MV1632
CR22	220099	DIODE, ZENER, 4.7V	04713	1N5992B
CR23	211083	DIODE, SILICO	81349	1N916B
CR24	220012	DIODE, SILICO, ZENER	81349	1N958B
CR25	220012	DIODE, SILICO, ZENER	81349	1N958B
CR26	220101	DIODE, ZENER, 3.3V, 5%	04713	1N5988B
F1	920930	FUSE, NORMAL BLO, 6A, 250V	75915	312006
F2	920930	FUSE, NORMAL BLO, 6A, 250V	75915	312006
J1	601192	CONNECTOR, PCB, 34P	52072	CA-D34-238-43
J2	600798	CONNECTOR, PLUG, 3P	27264	09-18-5031
J4	601221	CONNECTOR, EDGE, RECEPT., 20P	71785	50-20SN-4
J9	601214	CONNECTOR, EDGE, RECEPT., 72P	75856	RCR36-6142-15
J10	601221	CONNECTOR, EDGE, RECEPT., 20P	71785	50-20SN-4
J11	601217	CONNECTOR, PWR, PLUG, 15P	00779	9-350267-1
J12	601217	CONNECTOR, PWR, PLUG, 15P	00779	9-350267-1
J13	601218	CONNECTOR, PWR, PLUG, 6P	00779	9-350258-1

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
J14	601208-012	CONNECTOR, PCB, PLUG, 5P	21793	601208-012
J15	601208-013	CONNECTOR, PCB, PLUG, 30P	21793	601208-013
J16	600947	SOCKET, IC, 20P	52072	CA-20S-TSD-BC
J17	920734	SOCKET, IC, 14P	00779	583527-1
J18	601208-010	CONNECTOR, PCB, PLUG, 2P	21793	601208-010
J19	601208-010	CONNECTOR, PCB, PLUG, 2P	21793	601208-010
J20	601208-011	CONNECTOR, PCB, PLUG, 4P	21793	601208-011
J21	600947	SOCKET, IC, 20P	52072	CA-20S-TSD-BC
J203	601231	CONNECTOR, BNC, PC MOUNT	00779	227161-2
J204	601231	CONNECTOR, BNC, PC MOUNT	00779	227161-2
J205	601253	CONNECTOR, GPIB, 24P	00779	553811-3
J206	601231	CONNECTOR, BNC, PC MOUNT	00779	227161-2
J207	601231	CONNECTOR, BNC, PC MOUNT	00779	227161-2
J208	601231	CONNECTOR, BNC, PC MOUNT	00779	227161-2
J209	601231	CONNECTOR, BNC, PC MOUNT	00779	227161-2
L1	310051	CHOKE, RF, 1.00 VH, 10%	76493	9230-20
L2	310051	CHOKE, RF, 1.00 VH, 10%	76493	9230-20
L3	310051	CHOKE, RF, 1.00 VH, 10%	76493	9230-20
Q1	200295	TRANS, N-CHAN, MOS FET	17856	VN10KM
Q2	200299	TRANS, PNP	04713	2N3906
Q3	200298	TRANS, NPN	04713	2N3904

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
Q4	200068	TRANS, PNP	80131	2N4250
Q5	200068	TRANS, PNP	80131	2N4250
Q6	200298	TRANS, NPN	04713	2N3904
Q7	200252	TRANS, J-FET	27014	J174
Q8	200296	TRANS, P-CHAN, J-FET	17856	J177
Q9	200298	TRANS, NPN	04713	2N3904
Q10	200278	TRANS, PWR, SCR	04713	2N6504
Q11	200278	TRANS, PWR, SCR	04713	2N6504
Q12	200258	TRANS	07263	2N4248
Q13	200258	TRANS	07263	2N4248
Q14	200298	TRANS, NPN	04713	2N3904
Q15	200298	TRANS, NPN	04713	2N3904
Q16	200068	TRANS, PNP	80131	2N4250
R1	000104	RES, CARBON, 100K, 5%, 1/4W	81349	RC07GF104J
R2	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R3	000112	RES, CARBON, 1.1K, 5%, 1/4W	81349	RC07GF112J
R4	000104	RES, CARBON, 100K, 5%, 1/4W	81349	RC07GF104J
R5	000105	RES, CARBON, 1M, 5%, 1/4W	81349	RC07GF105J
R6	000474	RES, CARBON, 470K, 5%, 1/4W	81349	RC07GF474J
R7	000225	RES, CARBON, 2.2M, 5%, 1/4W	81349	RC07GF225J
R8	012004	RES, METAL, 4.12K, 1%, 1/8W	81349	RN55C4121F
R9	000472	RES, CARBON, 4.7K, 5%, 1/4W	81349	RC07GF472J
R10	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R11	010392	RES, METAL, 20K, .1%, 1/8W	81349	RN55C2002B

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
R12	000512	RES, CARBON, 5.1K, 5%, 1/4W	81349	RC07GF512J
R13	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R14	010392	RES, METAL, 20K, .1%, 1/8W	81349	RN55C2002B
R15	000512	RES, CARBON, 5.1K, 5%, 1/4W	81349	RC07GF512J
R16	010086	RES, METAL, 9.53K, 1/%, 1/4W	81349	RN60D9531F
R17	010385	RES, METAL, 19.1K, 1%, 1/4W	81349	RN60D1912F
R18	000221	RES, CARBON, 220 OHM, 5%, 1/4W	81349	RC07GF221J
R19	010086	RES, METAL, 9.53K, 1%, 1/4W	81349	RN60D9531F
R20	010385	RES, METAL, 19.1K, 1%, 1/4W	81349	RN60D1912F
R21	000222	RES, CARBON, 2.2K, 5%, 1/4W	81349	RC07GF222J
R22	000622	RES, CARBON, 6.2K, 5%, 1/4W	81349	RC07GF622J
R23	000331	RES, CARBON, 330 OHM, 5%, 1/4W	81349	RC07GF331J
R24	000472	RES, CARBON, 4.7K, 5%, 1/4W	81349	RC07GF472J
R25	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R26	000470	RES, CARBON, 47 OHM, 5%, 1/4W	81349	RC07GF470J
R27	000331	RES, CARBON, 330 OHM, 5%, 1/4W	81349	RC07GF331J
R28	000102	RES, CARBON, 1K, 5%, 1/4W	81349	RC07GF102J
R29	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R30	000432	RES, CARBON, 4.3K, 5%, 1/4W	81349	RC07GF432J
R31	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R32	000472	RES, CARBON, 4.7K, 5%, 1/4W	81349	RC07GF472J
R33	000472	RES, CARBON, 4.7K, 5%, 1/4W	81349	RC07GF472J
R34	000472	RES, CARBON, 4.7K, 5%, 1/4W	81349	RC07GF472J
R35	000104	RES, CARBON, 100K, 5%, 1/4W	81349	RC07GF104J

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
R36	000472	RES, CARBON, 4.7K, 5%, 1/4W	81349	RC07GF472J
R37	000102	RES, CARBON, 1K, 5%, 1/4W	81349	RC07GF102J
R38	000333	RES, CARBON, 33K, 5%, 1/4W	81349	RC07GF333J
R39	000470	RES, CARBON, 47 OHM, 5%, 1/4W	81349	RC07GF470J
R40	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R41	010123	RES, METAL, 23.7K, 1%, 1/8W	81349	RN55D2372F
R42	010125	RES, METAL, 16.2K, 1%, 1/4W	81349	RN60D1622F
R43	000470	RES, CARBON, 47 OHM, 5%, 1/4W	81349	RC07GF470J
R44	001881	RES, CARBON, 10 OHM, 5%, 1W	81349	RC32GF100J
R45	001881	RES, CARBON, 10 OHM, 5%, 1W	81349	RC32GF100J
R46	000681	RES, CARBON, 680 OHM, 5%, 1/4W	81349	RC07GF681J
R47	000432	RES, CARBON, 4.3K, 5%, 1/4W	81349	RC07GF432J
R48	010631	RES, METAL, 10.2K, 1%, 1/8W	81349	RN55C1022F
R49	000681	RES, CARBON, 680 OHM, 5%, 1/4W	81349	RC07GF681J
R50	000432	RES, CARBON, 4.3K, 5%, 1/4W	81349	RC07GF432J
R51	010631	RES, METAL, 10.2K, 1%, 1/8W	81349	RN55C1022F
R54	000681	RES, CARBON, 680 OHM, 5%, 1/4W	81349	RC07GF681J
R55	000681	RES, CARBON, 680 OHM, 5%, 1/4W	81349	RC07GF681J
R56	000510	RES, CARBON, 51 OHM, 5%, 1/4W	81349	RC07GF510J
R57	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R58	000472	RES, CARBON, 4.7K, 5%, 1/4W	81349	RC07GF472J
R59	000221	RES, CARBON, 220 OHM, 5%, 1/4W	81349	RC07GF221J

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
R60	000221	RES, CARBON, 220 OHM, 5%, 1/4W	81349	RC07GF221J
R61	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R62	000102	RES, CARBON, 1K, 5%, 1/4W	81349	RC07GF102J
R63	000822	RES, CARBON, 8.2K, 5%, 1/4W	81349	RC07GF822J
R64	001706	RES, CARBON, 510 OHM, 5%, 1/2W	81349	RC20GF511J
R65	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R66	000472	RES, CARBON, 4.7K, 5%, 1/4W	81349	RC07GF472J
R67	000102	RES, CARBON, 1K, 5%, 1/4W	81349	RC07GF102J
R68	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R69	000510	RES, CARBON, 51 OHM, 5%, 1/4W	81349	RC07GF510J
R70	000510	RES, CARBON, 51 OHM, 5%, 1/4W	81349	RC07GF510J
R71	000132	RES, CARBON, 1.3K, 5%, 1/4W	81349	RC07GF132J
R72	000132	RES, CARBON, 1.3K, 5%, 1/4W	81349	RC07GF132J
R74	000471	RES, CARBON, 470 OHM, 5%, 1/4W	81349	RC07GF471J
R75	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R76	000474	RES, CARBON, 470K, 5%, 1/4W	81349	RC07GF474J
R77	000104	RES, CARBON, 100K, 5%, 1/4W	81349	RC07GF104J
R78	000123	RES, CARBON, 12K, 5%, 1/4W	81349	RC07GF123J
R79	000221	RES, CARBON, 220 OHM, 5%, 1/4W	81349	RC07GF221J
R80	000221	RES, CARBON, 220 OHM, 5%, 1/4W	81349	RC07GF221J
R81	000331	RES, CARBON, 330 OHM, 5%, 1/4W	81349	RC07GF331J
R82	000561	RES, CARBON, 560 OHM, 5%, 1/4W	81349	RC07GF561J
R83	000512	RES, CARBON, 5.1K, 5%, 1/4W	81349	RC-8GF512J

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
R84	000560	RES, CARBON, 56 OHM, 5%, 1/4W	81349	RC07GF560J
R85	000471	RES, CARBON, 470 OHM, 5%, 1/4W	81349	RC07GF471J
R86	000624	RES, CARBON, 620K, 5%, 1/4W	81349	RC07GF624J
R87	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R88	000301	RES, CARBON, 300 OHM, 5%, 1/4W	81349	RC07GF301J
R89	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R90	000153	RES, CARBON, 15K, 5%, 1/4W	81349	RC07GF153J
R91	000560	RES, CARBON, 56 OHM, 5%, 1/4W	81349	RC07GF560J
R92	000182	RES, CARBON, 1.8K, 5%, 1/4W	81349	RC07GF182J
R93	000221	RES, CARBON, 220 OHM, 5%, 1/4W	81349	RC07GF221J
R94	000182	RES, CARBON, 1.8K, 5%, 1/4W	81349	RC07GF182J
R95	000432	RES, CARBON, 4.3K, 5%, 1/4W	81349	RC07GF432J
R96	000511	RES, CARBON, 510 OHM, 5%, 1/4W	81349	RC07GF511J
R97	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R98	000471	RES, CARBON, 470 OHM, 5%, 1/4W	81349	RC07GF471J
R99	000202	RES, CARBON, 2K, 5%, 1/4W	81349	RC07GF202J
R100	000302	RES, CARBON, 3K, 5%, 1/4W	81349	RC07GF302J
R101	000912	RES, CARBON, 9.1K, 5%, 1/4W	81349	RC07GF912J
R102	000104	RES, CARBON, 100K, 5%, 1/4W	81349	RC07GF104J
R103	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
S1	600975	SWITCH, PUSHBUTTON	71590	SPEC-PB12.5
T1	300104	TRANSFORMER, PULSE	55167	CMI945
U1	230547	IC, QUAD COMPARATOR	27014	LM339N

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
U2	230746	IC, MEMORY, NON-VOL, 2K X 8	61394	5516A-300
U3	230731	IC, DIGITAL, NAND, DUAL QUAD INPUT	07263	74F20PC
U4	230719	IC, FAST NAND	07263	74F00
U5	230705	IC, DIGITAL	04713	74F04
U6	230744	IC, MICRO, 68000, 8 MHZ	04713	MC68000G8
U7	230740	IC, MEMORY, RAM, 8K, 150 NS	52531	HM6264P-15
U8	230740	IC, MEMORY, RAM, 8K, 150 NS	52531	HM6264P-15
U9	230368	IC, DEMULTIPLEXER	27014	74LS138
U10	230741	IC, INTERFACE, DAC, 12 BIT	24355	AD7545KN
U11	230743	IC, LINEAR, DUAL OP AMP	27014	LF412CN
U12	230742	IC, DIGITAL, PRIORITY ENCODER	04713	SN7545KN
U13	230637	IC, DIGITAL	18324	N74LS244
U14	230752	IC, LINEAR, OP AMP	24355	ADOP07CN
U16	921005	OSC, CLOCK, 8 MHZ, 0.1%	04713	RASCO-3
U17	230813	IC, MEMORY, 64K X 8	21793	230813
U18	230812	IC, MEMORY, 64K X 8	21793	230812
U19	230741	IC, INTERFACE, DAC, 12 BIT	24355	AD7545KN
U20	230745	IC, LINEAR, VOLTAGE REF, 5V	04713	MC1404U5
U22	230368	IC, DEMULTIPLEXER	27014	74LS138
U23	230752	IC, LINEAR, OP AMP	24355	ADOP07CN
U24	230711	IC, DIGITAL	07263	74F32
U25	230760	IC, DIGITAL	27014	MM74HC37
U26	230422	IC, OCTAL	34335	AM8304B
U27	230330	IC, TRI-STATE BUFFER	01295	74LS367

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
U28	230704	IC, DIGITAL TIMER	27014	8254
U29	230386	IC, 8-BIT REGISTER	27014	74LS273
U30	230637	IC, DIGITAL	18324	N74LS244
U31	230386	IC, 8-BIT REGISTER	27014	74LS273
U32	230414	IC, QUAD EXCLUSIVE OR GATE	27014	74LS86
U33	230315	IC, MULTIPLEXER	01295	SN74LS153N
U34	230386	IC, 8-BIT REGISTER	27014	74LS273
U35	200294	TRANS, PNP, QUAD 40V	04713	MPQ2906
U36	200294	TRANS, PNP, QUAD 40V	04713	MPQ2906
U37	230428	IC, QUAD 2-INPUT OR GATE	27014	DM74LS32N
U38	230194	IC, 14 DIP, DUAL D FLIP-FLOP	01295	SN74LS74N
U39	230234	IC, 14 DIP, HEX INVERTER	01295	SN74LS04N
U40	230196	IC, 14 DIP, AND-OR-INV GATES	01295	SN74LS51N
U41	230507	IC, DIGITAL	27014	DM74LS54-K1
U42	230305	IC, QUAD, 2-INPUT AND GATES	01295	SN74LS08
U43	230194	IC, 14 DIP, DUAL D FLIP-FLOP	01295	SN74LS74N
U44	230386	IC, 8-BIT REGISTER	27014	74LS273N
U45	200294	TRANS, PNP, QUAD 40V	04713	MPQ2906
U46	230747	IC, LINEAR, VOLTAGE REG.	12969	UC3834N
U47	230747	IC, LINEAR, VOLTAGE REG.	12969	UC3834N
U48	230373	IC, VOLTAGE REGULATOR	04713	7815CT
U49	230378	IC, 3-TERM NEG. REGULATOR	27014	7915CT
U50	230442	IC, QUAD MTTL TO MECL TRANSL.	04713	MC10124
U51	230443	IC, QUAD MECL TO MTTL TRANSL.	04713	MC10125

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
U52	230750	IC, DIGITAL, ECL	04713	MC10216P
U53	230443	IC, QUAD MECL TO MTTL TRANSL.	04713	MC10125
U54	230751	IC, DIGITAL, ECL	04713	MC10130P
U55	230733	IC, DIGITAL, ECL FLIP-FLOP	04713	MC10231
U56	230442	IC, QUAD MTTL TO MECL TRANSL.	04713	MC10124
U57	230205	IC, QUAD 2, INPUT NOR GATE	04713	MC10102P
U58	230205	IC, QUAD 2, INPUT NOR GATE	04713	MC10102P
U59	230733	IC, DIGITAL, ECL FLIP-FLOP	04713	MC10231
U60	230205	IC, QUAD 2, INPUT NOR GATE	04713	MC10102P
U61	230793	IC, DIGITAL, GPIB	01295	TMS9914ANL
U62	230445	IC, 686 VOLTAGE COMPARATOR	34335	AM686CN-1
U63	230748	IC, LINEAR, OP AMP	01295	TL081C
U64	230792	IC, LINEAR, TRANS ARRAY	02735	CA3046
U65	230509	IC, DIGITAL	27014	74LS132N
U66	230757	IC, LINEAR, 710 COMPARATOR	27014	MC1710CH
U67	230459	IC, OCTAL GPIB TRANS	01295	SN75160
U68	230472	IC, OCTAL GPIB TRANS	01295	SN75161
W1	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2
W2	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2
W3	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2
W4	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2
W6	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2
W7	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2
W8	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
W9	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2
W11	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2
W12	601195	PLUG, JUMPER, 0.1 CTR, LOW PROFILE	00779	531220-2
Y1	921004	OSC, 10 MHZ, CRYSTAL	55411	HC18/U
Z1	080005	RES NETWORK, CERMET, 10K, 6P5R, 2%	11236	750-61-R10K OHM
Z2	080032	RES NETWORK, CERMET, 4.7K, 10P9R	11236	750-100-R4.7K OHM
Z3	080015	RES NETWORK, 10K, 5%	91637	CSP-10E-01103J
Z4	080023	RES NETWORK, 4.7K, 8P9R, 2%	11236	750-81-R4.7K OHM
Z5	080067	RES NETWORK, 2.2K, 8 RES	11236	763-3-2.2K
Z6	080035	RES NETWORK, 6K, 1.5W, 14P13R, 2%	11236	760-1-R6K OHM
Z7	080067	RES NETWORK, 2.2K, 8 RES	11236	761-3-2.2K
Z8	080002	RES NETWORK, 500 OHM, 8P7R, 2%	11236	750-81-R500 OHM
Z9	080080	RES NETWORK, 160 OHM, 8P7R	11236	750-81-R160 OHM
Z10	080081	RES NETWORK, 270 OHM, 8P7R	11236	750-81-R270 OHM
Z11	080002	RES NETWORK, 500 OHM, 8P7R, 2%	11236	750-81-R500 OHM
Z12	080002	RES NETWORK, 500 OHM, 8P7R, 2%	11236	750-81-R500 OHM
Z13	080002	RES NETWORK, 500 OHM, 8P7R, 2%	11236	750-81-R500 OHM
Z14	080002	RES NETWORK, 500 OHM, 8P7R, 2%	11236	750-81-R500 OHM

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
Z15	080068	RES NETWORK, CERMET, 470 OHM, 3 RES	11236	750-63-R470 OHM
Z16	080002	RES NETWORK, 500 OHM, 8P7R, 2%	11236	750-81-R500 OHM
Z17	080005	RES NETWORK, 10K, 6P5R, 2%	11236	750-61-R10K OHM
215	500002	TUBING, SHRINK, .153 ID	——	——
216	600786	POST TERMINAL TP1-TP17, TP19-TP27, E1-E12, E25-E27, W6-W11 (2 EA) (53 REQ'D)	00779	1-87022-0
218	411725	PCB, MOTHERBOARD (UNLOADED)	21793	411725
220	600947	SOCKET, IC, 20P (2 REQ'D)	52072	CA-20S-TSD-BC
225	611059	CONNECTOR, DIP, LOW PROFILE, 40P	91506	240-AG39D
229	601199	SOCKET, 64P, LOW PROFILE	06776	ICA-649-S-TG
248	630010	KIT, HDWRE, STANDOFF, STUD MT	00779	552633-3
251	601230	HEATSINK, TO-220	13103	6232B-MT
255	610001	STANDOFF, 6-32 X 3/8, CAD PLATED BRASS (5 REQ'D)	88245	1530-B-3/8
257	610905	BRACKET, ANGLE, 8-32 TAPPED	79963	34S
258	610949	RIVET, .205D X .276L	19738	1601-5307
260	611065	SPACER, 14-PIN DIP	32559	814-100
261	615043	SCREW, PPH, 4-40 X .312	——	——

401725 - PCB ASSY., MOTHERBOARD (CONT'D) J

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
262	616252	SCREW, PPH, SEMS ASSY., 4-40 X .312 (2 REQ'D)	78189	——
264	617004	NUT, HEX, 4-40	——	——
265	617077	WASHER, INT. LOCK, #4	——	——
268	920624	SOCKET, IC, 24P (2 REQ'D)	71785	133-29-02-063
272	920735	SOCKET, IC, 16P (2 REQ'D)	71785	133-51-02-006
274	920891	SOCKET, 28P, SOLDER TAIL (4 REQ'D)	52072	CA-28S-TSD
278	920971	FUSEHOLDER, PC MOUNT (4 REQ'D)	75915	122088

401726 - PCB ASSY., SIGNAL CONDITIONER D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C1	100056	CAP, CERAM, 8.2 PFD, 1000V, 5%	56289	C030B102E8R2D
C2	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C3	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C4	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C5	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C6	100056	CAP, CERAM, 8.2 PFD, 1000V, 5%	56289	C030B102E8R2D
C7	100063	CAP, CERAM, .01 MFD, 500V, 20%	56289	C023B501E103M
C8	100063	CAP, CERAM, .01 MFD, 500V, 20%	56289	C023B501E103M
C9	100063	CAP, CERAM, .01 MFD, 500V, 20%	56289	C023B501E103M
C10	100063	CAP, CERAM, .01 MFD, 500V, 20%	56289	C023B501E103M
C11	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C12	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C13	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C14	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C15	101174	CAP, ELECT, 10000 MFD, 15V	80031	3050HS103U015
C16	101174	CAP, ELECT, 10000 MFD, 15V	80031	3050HS103U015
C17	130170	CAP, TRIMMER, .5-3 PFD, 300V	80031	2502A0R503VP02 F00
C18	130170	CAP, TRIMMER, .5-3 PFD, 300V	80031	2502A0R503VP02 F00
C19	130170	CAP, TRIMMER, .5-3 PFD, 300V	80031	2502A0R503VP02 F00

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C20	130170	CAP, TRIMMER, .5-3 PFD, 300V	80031	2502A0R503VP02 F00
C22	100050	CAP, CERAM, 2.2 PFD, 1000V, 5%	56289	C030B102S2R2D
C23	100050	CAP, CERAM, 2.2 PFD, 1000V, 5%	56289	C030B102S2R2D
C25	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C26	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C27	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C28	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C29	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C30	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C31	100146	CAP, CERAM, 39 PFD, 100V, 5%	05397	C315C390J1G5CA
C32	130080	CAP, MICA, 22 PFD	72136	DM5E-220J
C33	130080	CAP, MICA, 22 PFD	72136	DM5E-220J
C34	100146	CAP, CERAM, 39 PFD, 100V, 5%	05397	C315C390J1G5CA
C35	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C36	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C37	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C38	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C39	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C40	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C41	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C42	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C43	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C44	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C45	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C46	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C47	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C48	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C49	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C50	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C51	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C52	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C53	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C54	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C55	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C56	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C57	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C58	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C59	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C60	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C61	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C62	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C63	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C64	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C65	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C66	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C67	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C68	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C69	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C70	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C71	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C72	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C73	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C74	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C75	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C76	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C77	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C78	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C79	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C80	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C81	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C82	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C83	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C84	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C85	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C86	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C87	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C88	130103	CAP, CERAM, .01 MFD, 25V, 20%	72982	GR42-6X7R103 M50Y
C89	130103	CAP, CERAM, .01 MFD, 25V, 20%	72982	GR42-6X7R103 M50Y
C90	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C91	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C92	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C93	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C94	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C95	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C96	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C97	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C98	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C99	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C100	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C101	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C102	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C103	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C104	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C105	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C106	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C107	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C108	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C109	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C110	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C111	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C112	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C113	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C114	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C115	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C116	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C117	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C118	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C119	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C120	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C121	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C122	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C123	110151	CAP, TANTA, 10 MFD, 35V, 20%	05397	T354G106M035AS
C124	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C125	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C126	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C127	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C128	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C129	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C130	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C131	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C132	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C133	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C134	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C135	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C136	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C137	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C138	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C139	130088	CAP, MICA, 5 PFD, 100V	72136	DM5D050-D0
C140	130088	CAP, MICA, 5 PFD, 100V	72136	DM5D050-D0
C141	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C142	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C143	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C144	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C145	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C146	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C147	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C148	100147	CAP, CERAM, 120 PFD, 100V, 5%	05397	C315C121J1G5CA
C149	100147	CAP, CERAM, 120 PFD, 100V, 5%	05397	C315C121J1G5CA
CR1	210036	DIODE	07263	FD300
CR2	211083	DIODE, SILICO	81349	1N916B
CR3	211083	DIODE, SILICO	81349	1N916B
CR4	210036	DIODE	07263	FD300
CR5	210036	DIODE	07263	FD300
CR6	211083	DIODE, SILICO	81349	1N916B
CR7	211083	DIODE, SILICO	81349	1N916B
CR8	210036	DIODE	07263	FD300
CR9	210090	DIODE	50434	HP5082-2800
CR10	210090	DIODE	50434	HP5082-2800
CR11	210090	DIODE	50434	HP5082-2800
CR12	210090	DIODE	50434	HP5082-2800

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
J5	600823	SOCKET, DUAL IN-LINE, 40P	52072	CA40S-TSO-BC
J6	920734	SOCKET, IC, 14P	00779	583527-1
J7	601208-010	CONNECTOR, PCB PLUG, 2 PIN	21793	601208-010
J8	601208-010	CONNECTOR, PCB PLUG, 2 PIN	21793	601208-010
J101	601234	CONNECTOR, BNC, PCB MOUNT	21793	601234
J102	601234	CONNECTOR, BNC, PCB MOUNT	21793	601234
K1	310164	RELAY, REED, 1A, 200V	71704	2900-067
K2	310164	RELAY, REED, 1A, 200V	71704	2900-067
K3	310164	RELAY, REED, 1A, 200V	71704	2900-067
K4	310164	RELAY, REED, 1A, 200V	71704	2900-067
K5	310164	RELAY, REED, 1A, 200V	71704	2900-067
K6	310157	RELAY, CRYSTAL, CAN, 2P-2T	11532	172-12 (R-D)
K7	310157	RELAY, CRYSTAL, CAN, 2P-2T	11532	172-12 (R-D)
K8	310164	RELAY, REED, 1A, 200V	71704	2900-067
K9	310164	RELAY, REED, 1A, 200V	71704	2900-067
K10	310165	RELAY, REED, 2C	21317	M2C5AHH
K11	310164	RELAY, REED, 1A, 200V	71707	2900-067
K12	310163	RELAY, REED, 1C	14908	3420
K13	310163	RELAY, REED, 1C	14908	3420
L1	310092	CHOKE, RF, .1 UH	76493	9230-94
L2	310092	CHOKE, RF, .1 UH	76493	9230-94
L3	310056	CHOKE, RF, .68 UH	76493	9230-16
L4	310056	CHOKE, RF, .68 UH	76493	9230-16

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
L5	310056	CHOKE, RF, .68 UH	76493	9230-16
L6	310056	CHOKE, RF, .68 UH	76493	9230-16
L7	310056	CHOKE, RF, .68 UH	76493	9230-16
L8	310056	CHOKE, RF, .68 UH	76493	9230-16
L9	310056	CHOKE, RF, .68 UH	76493	9230-16
L10	310056	CHOKE, RF, .68 UH	76493	9230-16
L11	310056	CHOKE, RF, .68 UH	76493	9230-16
L12	310056	CHOKE, RF, .68 UH	76493	9230-16
L13	310056	CHOKE, RF, .68 UH	76493	9230-16
L14	310056	CHOKE, RF, .68 UH	76493	9230-16
L15	310056	CHOKE, RF, .68 UH	76493	9230-16
L16	310056	CHOKE, RF, .68 UH	76493	9230-16
P9	601213	CONNECTOR, EDGE, PLUG, 72 PIN	57856	PR36-6101-15
Q1	200300	TRANSISTOR, NPN	04713	MPS6547
Q2	200291	TRANSISTOR, DMOS QUAD	17856	SD5000N
Q3	200291	TRANSISTOR, DMOS QUAD	17856	SD5000N
Q4	200300	TRANSISTOR, NPN	04713	MPS6547
Q5	200300	TRANSISTOR, NPN	04713	MPS6547
Q6	200300	TRANSISTOR, NPN	04713	MPS6547
Q7	200099	TRANSISTOR, PNP	81349	2N4258
Q8	200290	TRANSISTOR, NPN	52648	SL3127C
Q9	200290	TRANSISTOR, NPN	52648	SL3127C
Q10	200099	TRANSISTOR, PNP	81349	2N4258

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
Q11	200289	TRANSISTOR, DUAL, PNP	04713	MD5000
Q12	200289	TRANSISTOR, DUAL, PNP	04713	MD5000
Q13	200288	TRANSISTOR, FET, N-CHANNEL	17856	J105-18
Q14	200288	TRANSISTOR, FET, N-CHANNEL	17856	J105-18
R1	010137	RES, METAL 100 OHM, 1%, 1/4W	81349	RN60D1000F
R2	010137	RES, METAL 100 OHM, 1%, 1/4W	81349	RN60D1000F
R3	010137	RES, METAL 100 OHM, 1%, 1/4W	81349	RN60D1000F
R4	010137	RES, METAL 100 OHM, 1%, 1/4W	81349	RN60D1000F
R5	012123	RES, CERMET, 51 OHM, 1%, 1/4W	19647	MK132
R6	000102	RES, CARBON, 1K, 5%, 1/4W	81349	RC07GF102J
R7	000102	RES, CARBON, 1K, 5%, 1/4W	81349	RC07GF102J
R8	012123	RES, CERMET, 51 OHM, 1%, 1/4W	19647	MK132
R9	000680	RES, CARBON, 68 OHM, 5%, 1/4W,	81349	RC07GF680J
R10	000680	RES, CARBON, 68 OHM, 5%, 1/4W,	81349	RC07GF680J
R11	010650	RES, METAL, 1M, 1%, 1/8W	81349	RN55E1004F
R12	010650	RES, METAL, 1M, 1%, 1/8W	81349	RN55E1004F
R13	000510	RES, CARBON, 51 OHM, 5%, 1/4W	81349	RC07GF510J
R14	000510	RES, CARBON, 51 OHM, 5%, 1/4W	81349	RC07GF510J
R15	000474	RES, CARBON, 470K, 5%, 1/4W	81349	RC07GF474J
R16	010536	RES, METAL, 100K, 1%, 1/8W	81349	RN55C1003F
R17	010536	RES, METAL, 100K, 1%, 1/8W	81349	RN55C1003F
R18	000474	RES, CARBON, 470K, 5%, 1/4W	81349	RC07GF474J
R19	012110	RES, CERMET, 1.96M, 1%, 1/4W	19647	MK132
R20	012111	RES, CERMET, 1.8M, 1%, 1/4W	19647	MK132

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
R21	012111	RES, CERMET, 1.8M, 1%, 1/4W	19647	MK132
R22	012110	RES, CERMET, 1.96M, 1%, 1/4W	19647	MK132
R23	012109	RES, CERMET, 41.67K, 1%, 1/4W	19647	MK132
R24	012108	RES, CERMET, 250K, 1%, 1/4W	19647	MK132
R25	012108	RES, CERMET, 250K, 1%, 1/4W	19647	MK132
R26	012109	RES, CERMET, 41.67K, 1%, 1/4W	19647	MK132
R27	000300	RES, CARBON, 30 OHM, 5%, 1/4W	81349	RC07GF300J
R28	000300	RES, CARBON, 30 OHM, 5%, 1/4W	81349	RC07GF300J
R29	000470	RES, CARBON, 47 OHM, 5%, 1/4W	80349	RC07GF470J
R30	000470	RES, CARBON, 47 OHM, 5%, 1/4W	80349	RC07GF470J
R31	000102	RES, CARBON, 1K, 5%, 1/4W	81349	RC07GF102J
R32	012114	RES, METAL FILM, 316 OHM, 1%, 1/8W	81349	RN55C3160F
R33	012118	RES, METAL FILM, 1.5K, 1%, 1/8W	81349	RN55C1501F
R34	012118	RES, METAL FILM, 1.5K, 1%, 1/8W	81349	RN55C1501F
R35	012114	RES, METAL FILM, 316 OHM, 1%, 1/8W	81349	RN55C3160F
R36	012114	RES, METAL FILM, 316 OHM, 1%, 1/8W	81349	RN55C3160F
R37	012118	RES, METAL FILM, 1.5K, 1%, 1/8W	81349	RN55C1501F
R38	000105	RES, CARBON, 1M, 5%, 1/4W	81349	RC07GF105J
R39	012118	RES, METAL FILM, 1.5K, 1%, 1/8W	81349	RN55C1501F
R40	012114	RES, METAL FILM, 316 OHM, 1%, 1/8W	81349	RN55C3160F
R41	000102	RES, CARBON, 1K, 5%, 1/4W	81349	RC07GF102J
R42	000105	RES, CARBON, 1M, 5%, 1/4W	81349	RC07GF105J
R43	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R44	010628	RES, METAL, 3.01K, 1%, 1/8W	81349	RN55C3011F

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
R45	010628	RES, METAL, 3.01K, 1%, 1/8W	81349	RN55C3011F
R46	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R47	012121	RES, CERMET, 82.5 OHM, 1%, 1/4W	19647	MK120
R48	000122	RES, CARBON, 1.2K, 5%, 1/4W	81349	RC07GF122J
R49	012121	RES, CERMET, 82.5 OHM, 1%, 1/4W	19647	MK120
R50	000102	RES, CARBON, 1K, 5%, 1/4W	81349	RC07GF102J
R51	012084	RES, METAL FILM, 100 OHM, 1%, 1/8W	81349	RN55C10R0F
R52	010918	RES, METAL, 499 OHM, 1%, 1/8W	81349	RN55C4990F
R53	012121	RES, CERMET, 82.5 OHM, 1%, 1/4W	19647	MK120
R54	012121	RES, CERMET, 82.5 OHM, 1%, 1/4W	19647	MK120
R55	010918	RES, METAL, 499 OHM, 1%, 1/8W	81349	RN55C4990F
R56	012084	RES, METAL FILM, 100 OHM, 1%, 1/8W	81349	RN55C10R0F
R57	012084	RES, METAL FILM, 100 OHM, 1%, 1/8W	81349	RN55C10R0F
R58	012084	RES, METAL FILM, 100 OHM, 1%, 1/8W	81349	RN55C10R0F
R59	012084	RES, METAL FILM, 100 OHM, 1%, 1/8W	81349	RN55C10R0F
R60	012084	RES, METAL FILM, 100 OHM, 1%, 1/8W	81349	RN55C10R0F
R61	012120	RES, CERMET, 1.5K, 1%, 1/4W	19647	MK120
R62	012122	RES, CERMET, 10 OHM, 1%, 1/4W	SEE NOTE 2 TABLE 7.1	LC-100
R63	012122	RES, CERMET, 10 OHM, 1%, 1/4W	SEE NOTE 2 TABLE 7.1	LC-100
R64	012120	RES, CERMET, 1.5K, 1%, 1/4W	19647	MK120
R65	012116	RES, METAL FILM, 475 OHM, 1%, 1/8W	81349	RN55C4750F
R66	012124	RES, METAL FILM, 301 OHM, 1%, 1/8W	81349	RN55C3010F
R67	040310	POT, CERMET, TOP ADJ, 1K, 10%	32997	3266W-1-102
R68	012115	RES, METAL FILM, 374 OHM, 1%, 1/8W	81349	RN55C3740F

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
R69	012084	RES, METAL FILM, 100 OHM, 1%, 1/8W	81349	RN55C10R0F
R70	040310	POT, CERMET, TOP ADJ, 1K, 10%	32997	3266W-1-102
R71	040310	POT, CERMET, TOP ADJ, 1K, 10%	32997	3266W-1-102
R72	010925	RES, METAL FILM, 1.33K, 1%, 1/8W	81349	RN55C1331F
R73	010704	RES, METAL, 1K, 1%, 1/8W	81349	RN55D1001F
R74	010704	RES, METAL, 1K, 1%, 1/8W	81349	RN55D1001F
R75	000161	RES, CARBON, 160 OHM, 5%, 1/4W	81349	RC07GF161J
R76	000161	RES, CARBON, 160 OHM, 5%, 1/4W	81349	RC07GF161J
R77	000271	RES, CARBON, 270 OHM, 5%, 1/4W	81349	RC07GF271J
R78	000271	RES, CARBON, 270 OHM, 5%, 1/4W	81349	RC07GF271J
R79	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R80	000680	RES, CARBON, 68 OHM, 5%, 1/4W	81349	RC07GF680J
R81	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
R82	001787	RES, CARBON, 20 OHM, 5%, 1/8W	81349	RC05GF200J
R83	001787	RES, CARBON, 20 OHM, 5%, 1/8W	81349	RC05GF200J
R84	000101	RES, CARBON, 100 OHM, 5%, 1/4W	81349	RC07GF101J
U1	230753	IC, DIGITAL, I & SENSITIVITY CONTROL	54473	3U15C13
U2	230753	IC, DIGITAL, I & SENSITIVITY CONTROL	54473	3U15C13
U3	230754	IC, LINEAR	01295	VA78L10ACLP
U4	230735	IC, COMPARATOR, DUAL ULTRA FAST	52648	SP9687DG
U5	230736	IC, INT., DUAL COMPARATOR	27014	LM2903N
U6	230750	IC, DIGITAL, ECL	04713	MC10216P
U7	230783	IC, ECL, HS QUAD 2-INPUT MUX	04713	MC10H158P
U8	230733	IC, DIGITAL, ECL FLIP-FLOP	04713	MC10231
U9	230750	IC, DIGITAL, ECL	04713	MC10216P

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
U10	230791	IC, DIGITAL	21793	230791
U11	230790	IC, DIGITAL	21793	230790
VR1	220007	DIODE, SILICO, ZENER	81349	1N751A
VR2	220007	DIODE, SILICO, ZENER	81349	1N751A
VR3	220007	DIODE, SILICO, ZENER	81349	1N751A
VR4	220098	DIODE, ZENER, 3.9V, 5%	04713	1N5990B
VR5	220098	DIODE, ZENER, 3.9V, 5%	04713	1N5990B
VR6	220098	DIODE, ZENER, 3.9V, 5%	04713	1N5990B
VR7	220098	DIODE, ZENER, 3.9V, 5%	04713	1N5990B
VR8	220101	DIODE, ZENER, 3.3V, 5%	04713	1N5988B
W1	601023	PLUG, JUMPER	98291	026-4802
Z1	080069	RES NETWORK, CERMET, 2.2K, 3R	11236	750-63-R2.2K
Z2	080068	RES NETWORK, CERMET, 470 OHM, 3R	11236	750-63-R470
Z3	080068	RES NETWORK, CERMET, 470 OHM, 3R	11236	750-63-R470
Z4	080069	RES NETWORK, CERMET, 2.2K, 3R	11236	750-63-R2.2K
Z5	080064	RES NETWORK, CERMET, 330 OHM, 5R	11236	750-61-R330
Z6	080064	RES NETWORK, CERMET, 330 OHM, 5R	11236	750-61-R330
Z7	080065	RES NETWORK, CERMET, 33 OHM, 5R	11236	750-61-R33
Z8	080040	RES NETWORK, CERMET, 22K, 8P4R, 2%, 1.1W	11236	750-83-R22K
Z9	080039	RES NETWORK, CERMET, 100K, 6P3R, 2%, .9W	11236	750-63-R100K
Z10	080064	RES NETWORK, CERMET, 330 OHM, 5R	11236	750-61-R330
Z12	080064	RES NETWORK, CERMET, 330 OHM, 5R	11236	750-61-R330
Z13	080001	RES NETWORK, CERMET, 330 OHM, 8P7R, 2%	11236	750-81-R330

401726 - PCB ASSY., SIGNAL CONDITIONER (CONT'D) D

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
Z14	080002	RES NETWORK, CERMET, 500 OHM, 8P7R, 2%	11236	750-81-R500
112	401728	PCB ASSY., MCC2 SYNCH	21793	401728
113	411726	PC BOARD, SIGNAL COND. (UNLOADED)	21793	411726
115	453936	RETAINER, FOAM, ADHESIVE	21793	453936
116	600786	POST, TERMINAL (TP5-12, W1 (2)) (10 REQ'D)	00779	1-87022-0
118	610912	CLIP, FLAT, CABLE	34785	031-0100
123	500022	WIRE, BARE COPPER, TRIMMED, SOLID, 22 GA	21793	500022
124	610227	NUT, PRESS, 2-56 (6 REQ'D)	46384	KF2-256
125	610612	STANDOFF, SWAGE, 4-40 X .453 (2 REQ'D)	06540	9536B-29-A0440-16
126	611032	SPACER, .2 CTR, .04 SHT, 2-LEAD (2 REQ'D)	32559	302-200
128	611043	WASHER, FLAT, #2, NYLON (2 REQ'D)	86928	5610-9-20
129	611059	CONNECTOR, DIP, LOW PROFILE, 40P	91506	240-AG-39D
130	611060	CONNECTOR, DIP, LOW PROFILE, 16P (3 REQ'D)	91506	216-AG-39D
132	615017	SCREW, PPH, 2-56 X .438 (2 REQ'D)	——	——
133	615019	SCREW, PPH, 2-56 X .625 (4 REQ'D)	——	——
134	616252	SCREW, PPH, SEMS ASSY., 4-40 X .312 (2 REQ'D)	78189	——
135	617126	WASHER, LOCK, #2, LIGHT SERIES (4 REQ'D)	——	——
137	920563	BEADS, SHIELDING (8 REQ'D)	02114	56-59065/4B
139	920962	LOCTITE, 242, MED STR.	05972	242

401728 - PCB ASSY., AMCC2 SYNCH A

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C1	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C2	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C3	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C4	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C5	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C6	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C7	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C8	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C9	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C10	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C11	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C12	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
C13	100062	CAP, CERAM, .01 MFD, 100V, 10%	72982	8121-100-W5R0-103K
Q1	200300	TRANSISTOR, NPN	04713	MPS6547
Q2	200300	TRANSISTOR, NPN	04713	MPS6547
Q3	200300	TRANSISTOR, NPN	04713	MPS6547
Q4	200300	TRANSISTOR, NPN	04713	MPS6547

401728 - PCB ASSY., AMCC2 SYNCH (CONT'D) A

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
U1	230787	IC, DIGITAL, TRIPLE LINE REC'R	04713	MC10116P
U2	230787	IC, DIGITAL, TRIPLE LINE REC'R	04713	MC10116P
U3	230442	IC, DIGITAL	04713	MC10124
U4	230785	IC, DIGITAL, TRIPLE X OR GATE	04713	MC10H107
U5	230787	IC, DIGITAL, TRIPLE LINE REC'R	04713	MC10116P
U6	230789	IC, DIGITAL, ECL/TTL CHIP	21793	230789
U7	230735	IC, COMPARATOR, DUAL ULTRA FAST	52648	SP9687DG
Z1	080075	RES NETWORK, CERMET, 470 OHM, 7R	11236	750-81-R470
Z2	080073	RES NETWORK, CERMET, 470 OHM, 5R	11236	750-61-R470
Z3	080073	RES NETWORK, CERMET, 470 OHM, 5R	11236	750-61-R470
Z4	080064	RES NETWORK, CERMET, 330 OHM, 5R	11236	750-61-R330
Z5	080073	RES NETWORK, CERMET, 470 OHM, 5R	11236	750-61-R470
Z6	080075	RES NETWORK, CERMET, 470 OHM, 7R	11236	750-81-R470
Z7	080064	RES NETWORK, CERMET, 330 OHM, 5R	11236	750-61-R330
Z8	080064	RES NETWORK, CERMET, 330 OHM, 5R	11236	750-61-R330
Z11	080004	RES NETWORK, CERMET, 4.7K, 6P5R, 2%	11236	750-61-R4.7K
Z12	080074	RES NETWORK, CERMET, 22K, 5R	11236	750-61-R22K
Z13	080004	RES NETWORK, CERMET, 4.7K, 6P5R, 2%	11236	750-61-R4.7K
Z14	080004	RES NETWORK, CERMET, 4.7K, 6P5R, 2%	11236	750-61-R4.7K
Z15	080074	RES NETWORK, CERMET, 22K, 5R	11236	750-61-R22K
19	411728	PCB, AMCC2, SYNCH (UNLOADED)	21793	411728
20	601019	CONNECTOR, TERM. STRIP, 20P, (2 REQ'D)	55322	TS-120-G-A1

401728 - PCB ASSY., AMCC2 SYNCH (CONT'D) A

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
21	611059	CONNECTOR, DIP, LOW PROFILE, 40P	91506	240-AG39D
22	611060	CONNECTOR, DIP, LOW PROFILE, 16P (3 REQ'D)	91506	216-AG39D

401727 - PCB ASSY., DISPLAY KEYBOARD E

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
C1	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C2	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C3	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C4	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C5	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C6	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C7	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C8	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C9	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
C10	100133	CAP, CERAM, .1 MFD, LOW PROFILE, 20%	72982	8131LP-100-651-104M
CR1	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR2	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR3	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR4	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR5	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR6	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR7	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR8	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR9	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122

401727 - PCB ASSY., DISPLAY KEYBOARD (CONT'D) E

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
CR10	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR11	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR12	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR13	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR14	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR15	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR16	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR17	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR18	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR19	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR20	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR21	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR22	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR23	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR24	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR25	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR26	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR27	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR28	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR29	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR30	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR31	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR32	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR33	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112

401727 - PCB ASSY., DISPLAY KEYBOARD (CONT'D) E

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
CR34	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR35	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR36	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR37	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR38	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR39	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR40	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR41	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR42	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR43	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR44	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR45	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR46	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR47	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR49	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR50	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR51	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR52	210106	DIODE, LIGHT EMITTING, RED	25088	LDH1112
CR53	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
CR54	210108	DIODE, LIGHT EMITTING, RED	25088	LDH5122
DS1	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS2	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS3	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS4	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510

401727 - PCB ASSY., DISPLAY KEYBOARD (CONT'D) E

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
DS5	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS6	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS7	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS8	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS9	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS10	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS11	210105	DISPLAY, NUMERIC, RED, R.H. DECIMAL	25088	DL-76510
DS12	210104	DISPLAY, 7 SEGMENT, 4 DIGIT	25088	DL340M
DS13	210104	DISPLAY, 7 SEGMENT, 4 DIGIT	25088	DL340M
P1	601223	CABLE ASSY., 34 CONDUCTOR	52072	CA-D34IDPSL-126/34IDS2-G-DD-003
R1	000561	RES, CARBON, 560 OHM, 5%, 1/4W	81349	RC07GF561J
R2	000561	RES, CARBON, 560 OHM, 5%, 1/4W	81349	RC07GF561J
R3	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R4	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R5	000561	RES, CARBON, 560 OHM, 5%, 1/4W	81349	RC07GF561J
R6	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
R7	000103	RES, CARBON, 10K, 5%, 1/4W	81349	RC07GF103J
S1	601211	SWITCH, PUSHBUTTON	21793	601211
S2	601211	SWITCH, PUSHBUTTON	21793	601211
S3	601211	SWITCH, PUSHBUTTON	21793	601211
S4	601211	SWITCH, PUSHBUTTON	21793	601211

401727 - PCB ASSY., DISPLAY KEYBOARD (CONT'D) E

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
S5	601211	SWITCH, PUSHBUTTON	21793	601211
S6	601211	SWITCH, PUSHBUTTON	21793	601211
S7	601211	SWITCH, PUSHBUTTON	21793	601211
S8	601211	SWITCH, PUSHBUTTON	21793	601211
S9	601211	SWITCH, PUSHBUTTON	21793	601211
S10	601211	SWITCH, PUSHBUTTON	21793	601211
S11	601211	SWITCH, PUSHBUTTON	21793	601211
S12	601211	SWITCH, PUSHBUTTON	21793	601211
S13	601211	SWITCH, PUSHBUTTON	21793	601211
S14	601211	SWITCH, PUSHBUTTON	21793	601211
S15	601211	SWITCH, PUSHBUTTON	21793	601211
S16	601211	SWITCH, PUSHBUTTON	21793	601211
S17	601211	SWITCH, PUSHBUTTON	21793	601211
S18	601211	SWITCH, PUSHBUTTON	21793	601211
S19	601211	SWITCH, PUSHBUTTON	21793	601211
S20	601211	SWITCH, PUSHBUTTON	21793	601211
S21	601211	SWITCH, PUSHBUTTON	21793	601211
S22	601211	SWITCH, PUSHBUTTON	21793	601211
S23	601211	SWITCH, PUSHBUTTON	21793	601211
S24	601211	SWITCH, PUSHBUTTON	21793	601211
S25	601211	SWITCH, PUSHBUTTON	21793	601211
S26	601211	SWITCH, PUSHBUTTON	21793	601211
S27	601211	SWITCH, PUSHBUTTON	21793	601211
S28	601211	SWITCH, PUSHBUTTON	21793	601211

401727 - PCB ASSY., DISPLAY KEYBOARD (CONT'D) E

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
S29	601211	SWITCH, PUSHBUTTON	21793	601211
S30	601211	SWITCH, PUSHBUTTON	21793	601211
S31	601211	SWITCH, PUSHBUTTON	21793	601211
S32	601211	SWITCH, PUSHBUTTON	21793	601211
S33	601211	SWITCH, PUSHBUTTON	21793	601211
S34	601211	SWITCH, PUSHBUTTON	21793	601211
S35	601211	SWITCH, PUSHBUTTON	21793	601211
S36	601211	SWITCH, PUSHBUTTON	21793	601211
S37	601211	SWITCH, PUSHBUTTON	21793	601211
S38	601211	SWITCH, PUSHBUTTON	21793	601211
S39	601211	SWITCH, PUSHBUTTON	21793	601211
S40	601211	SWITCH, PUSHBUTTON	21793	601211
S41	920905	SWITCH, MOMENTARY, SPST	31918	81519
U1	230457	IC, LED DRIVER	50579	ICM7218A
U2	230457	IC, LED DRIVER	50579	ICM7218A
U3	230386	IC, DIGITAL	27014	74LS273
U4	230506	IC, INTERFACE 8-DIGIT LED DRIVES	32293	ICM7218B-1P1
U5	230386	IC, DIGITAL	27014	74LS273
U6	230386	IC, DIGITAL	27014	74LS273
U7	230636	IC, OCTAL BUFFER	18324	74LS244F
U8	230368	IC, DEMULTIPLEXER	27014	74LS138
Z1	080050	RES NETWORK, 470 OHM, 10P9R	11236	750-101-R470
Z2	080023	RES NETWORK, CERMET, 4.7K, 8P7R, 2%	11236	750-81-R4.7K

401727 - PCB ASSY., DISPLAY KEYBOARD (CONT'D) E

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
26	411727	PCB, DISPLAY, KEYBOARD (UNLOADED)	21793	411727
29	454817	SPACER, LED, 7 POSITION (2 REQ'D)	21793	454817
30	454817-021	SPACER, LED, 3 POS. MOD.	21793	454817-021
31	454817-022	SPACER, LED, 4 POS. MOD.	21793	454817-022
39	611057	SPACER, LED, 1 POS. (7 REQ'D)	21793	611057
40	611065	SPACER, 14-PIN DIP (2 REQ'D)	32559	814-100
43	921007	CAP, SWITCH, GRAY (39 REQ'D)	21793	921007
44	921009	CAP, SWITCH, BLUE	21793	921009

404331 - ASSY., REAR PANEL E

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
B200	921015	FAN, DC, 20 CFM, 2.38 SQ	21793	921015
C200	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
C201	110126	CAP, TANTA, 6.8 MFD, 35V, 20%	05397	T355F685M035AS
CR200	230594	IC, FULL WAVE RECT. BRIDGE	27777	VH148
J211	601219	CONNECTOR, PWR, EMI FILTER	05245	6J4
P11	601215	CONNECTOR, PWR, HOUSING, 15P	00779	1-350244-9
P13	601216	CONNECTOR, PWR, HOUSING, 6P	00779	1-350241-9
P20	611055	CONNECTOR, CABLE, 4 PIN	00779	530554-3
Q200	200301	TRANSISTOR, PNP, PWR, 75W	04713	MJE2955T
Q201	200302	TRANSISTOR, NPN, PWR, 75W	04713	MJE3055T
S200	601112	SWITCH, ROCKER, DPST	NOTE 3 TABLE 8.1	1855.1102
U200	230788	IC, LINEAR, V REG	04713	LM340AT-5.0
2	404331-001	ASSY., REGULATOR	21793	404331-001
5	404331-002	ASSY., POWER RECPTLE	21793	404331-002
10	454592	BOOT, CONN. INSULATOR	21793	454592
11	454763	PANEL, REAR	21793	454763
13	454822-020	HOUSING, FAN, STD.	21793	454822-020
14	454823	GUARD, FINGER, FAN	21793	454823
15	454824	HEATSINK, BRKT, RIGHT	21793	454824
16	454825	HEATSINK, BRKT, LEFT	21793	454825

404331 - ASSY., REAR PANEL (CONT'D) A

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
17	522222	WIRE, TEFLON, STR, 18G, RED	——	——
18	500052	WIRE, TEFLON, STR, 18G, BLK	——	——
19	500061	WIRE, TEFLON, STR, 18G, WHT	——	——
20	500064	TUBING, SHRINK, .093ID, BLK	——	——
21	522333	WIRE, TEFLON, STR, 18G, ORG	——	——
22	500070	WIRE, TEFLON, STR, 18G, BLK/RED	——	——
23	500071	WIRE, TEFLON, STR, 18G, BLK/ORG	——	——
24	500074	WIRE, TEFLON, STR, 18G, WHT/ORG	——	——
25	522244	WIRE, TEFLON, STR, 18G, YEL	——	——
26	500212	WIRE, TEFLON, STR, 18G, GRN	——	——
27	500214	WIRE, TEFLON, STR, 18G, BRN	——	——
28	500215	WIRE, TEFLON, STR, 18G, GRN/YEL	——	——
29	500216	WIRE, TEFLON, STR, 18G, BLU	——	——
30	522777	WIRE, TEFLON, STR, 18G, VIO	——	——
31	600022	LUG, SOLDER	83330	1416-6
33	600745	TERMINAL, RECEPTACLE	00779	60196-3
35	601011	TERMINAL, CRIMP, .039 DIA	00779	60059-2
38	601212	TERMINAL, CRIMP, 18-26	00779	641294-1
44	610777	CABLE TIE	53421	T18R
46	610820	WASHER, SHOULDER, TO-220	13103	14875
48	610851	WASHER, INSULATING, TIP-32 STYLE	18565	60-11-5791-1674
49	610889	SCREW, PPH, 4-40 X .375	——	——
50	500056	TUBING, CLR, 3/16" DIA	——	——
51	611052	KEY, POLARIZING, PLUG	00779	87077-1

404331 - ASSY., REAR PANEL (CONT'D) A

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
52	611053	TERMINAL, CRIMP (2 REQ'D)	00779	530553-2
55	615068	SCREW, PPH, 6-32 X 1.50 (4 REQ'D)	——	——
57	616252	SCREW, PPH, SEMS ASSY., 4-40 X .312 (4 REQ'D)	78189	——
59	617005	NUT, HEX, 6-32	——	——
61	617103	WASHER, FLAT, #6, LIGHT SERIES (4 REQ'D)	——	——
63	617128	WASHER, LOCK, #6, LIGHT SERIES (4 REQ'D)	——	——
65	920364	FUSE, SLO BLO, 1A	75915	313.001S

404378 - ASSY., REAR INPUT (OPT. 01) A

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
1	401752	PCB ASSY., REAR INPUT	21793	401752
5	601222	CABLE ASSY., 72 CONDUCT	21793	601222
7	611058	STANDOFF, 6-32 X 1.25 (5 REQ'D)	06540	8224-SS-0632-F
9	616255	SCREW, PPH, SEMS ASSY (9 REQ'D)	21793	616255

401752 - PCB ASSY., REAR INPUT B

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
1	411752	PCB, REAR INPUT (UNLOADED)	21793	411752
4	601213	CONNECTOR, EDGE, PLUG 72 PIN (2 REQ'D)	57856	PR36-6141-15
6	610227	NUT, PRESS, 2-56 (4 REQ'D)	46384	KF2-256
8	615017	SCREW, PPH, 2-56 X .438 (4 REQ'D)	——	——
9	920962	LOCTITE, 242, MED STR	05972	242
10	610198	WASHER, FLAT, NYLON, #4 (4 REQ'D)	86928	5610-10-31

404384 - OPT. 04E, OSCILLATOR — A

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
3	404386	OSCILLATOR ASSY	21793	404386
5	610777	CABLE TIE	53421	T18R
7	611067	SCREW, METRIC, M3 X 8 (2 REQ'D)	——	——
9	617102	WASHER, FLAT, #4, LIGHT SERIES (2 REQ'D)	——	——
10	617127	WASHER, LOCK, #4, LIGHT SERIES (2 REQ'D)	——	——

404386 - OSCILLATOR ASSY. (OPT. 04E) — B

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
J4	611056	CONNECTOR, CABLE, 5-PIN	21793	611056
1	19-1238	PCB ASSY, DOUBLER	21793	19-1238
2	454879	FREQUENCY STD, 5 MHZ	21793	454879
4	500064	TUBING, SHRINK, .093 ID	——	——
6	610304	SPACER, 1/4 D X 1/2 LG (2 REQ'D)	——	——
8	611074	SCREW, METRIC, M3 X 10 (2 REQ'D)	——	——
10	617102	WASHER, FLAT, #4, LIGHT SERIES (2 REQ'D)	——	——
11	617127	WASHER, LOCK, #4, LIGHT SERIES (2 REQ'D)	——	——
13	500009	TUBING, SHRINK, .125 ID, BLK	29005	RNF-100-1-1/8
15	500174	CABLE, COAX, LOW THERMAL	21793	500174
17	524555	WIRE, TEFLON, STRANDED, 24 GA, GRN	——	——
18	524929	WIRE, TEFLON, STRANDED, 24 GA, WHT/RED	——	——
20	610777	CABLE TIE	53421	T18R
22	611052	KEY, POLARIZING, PLUG	00779	87077-1
23	611053	TERMINAL, CRIMP	00779	530553-2

404387 - 220V/240V OPERATION (OPT. 71) — A

REF DESIG.	RACAL-DANA P/N	DESCRIPTION	FSC	MFG. P/N
1	920204	FUSE, SLO BLO, .50A., 250V	75915	3AG1/2ASB

RACAL-DANA Instruments Inc.

REGIONAL TECHNICAL CENTERS

Western

Racal-Dana Instruments Inc.
4 Goodyear Street
P.O. Box C-19541
Irvine, CA 92713-9541
714-859-8999
213-628-8825

Midwestern

Racal-Dana Instruments Inc.
221 E. Lake Street
Suite 103
Addison, IL 60101
312-279-8846/7/8

Eastern

Racal-Dana Instruments Inc.
5101-D Backlick Road
Annandale, VA 22003-6037
703-941-0525

LOCAL NORTH AMERICAN SALES OFFICES

ALABAMA
(813) 968-1742

ALASKA
(503) 283-0132

ARIZONA
(602) 894-2335

ARKANSAS
(713) 780-2511

CALIFORNIA
Northern
(408) 727-2341
Southern
(714) 859-8999
Los Angeles
(213) 628-8825

COLORADO
(303) 790-1700

CONNECTICUT
(203) 528-5357

DELAWARE
(703) 941-0525

DISTRICT OF COLUMBIA
(703) 951-0525

FLORIDA
(813) 968-1742

GEORGIA
(813) 968-1742

HAWAII
(808) 847-4300

IDAHO
(503) 283-0132

ILLINOIS
(312) 539-4838

INDIANA
(317) 253-1681

IOWA
(319) 377-9434

KANSAS
(913) 722-1030

KENTUCKY
Eastern
(216) 442-8080
Western
(312) 539-4838

LOUISIANA
(713) 780-2511

MAINE
(617) 273-3844

MARYLAND
(703) 941-0525

MASSACHUSETTS
(617) 273-3844

MICHIGAN
(313) 358-2505

MINNESOTA
(612) 476-1551

MISSISSIPPI
(813) 968-1742

MISSOURI
(314) 991-5363

MONTANA
(503) 283-0132

NEBRASKA
(312) 539-4838

NEVADA
(602) 894-2335

NEW HAMPSHIRE
(617) 273-3844

NEW JERSEY
Northern
(201) 423-3039
Southern
(609) 853-1605

NEW MEXICO
(505) 262-1525

NEW YORK
New York City,
Long Island
(516) 242-3454
Upstate New York
(315) 455-7314

NORTH CAROLINA
(813) 968-1742

NORTH DAKOTA
(312) 539-4838

OHIO
Cleveland
(216) 442-8080
Columbus
(614) 876-8305
Dayton
(513) 426-5310

OKLAHOMA
(918) 599-8315

OREGON
(503) 283-0132

PENNSYLVANIA
(609) 853-1605

PUERTO RICO
(813) 968-1742

RHODE ISLAND
(203) 528-5357

SOUTH CAROLINA
(813) 968-1742

SOUTH DAKOTA
(312) 539-4838

TENNESEE
(813) 968-1742

TEXAS
Austin
(512) 443-7722
Dallas
(214) 661-0300
Houston
(713) 780-2511
San Antonio
(512) 828-5741
Tulsa
(918) 494-2711

UTAH
(602) 894-2335

VERMONT
(617) 273-3844

VIRGINIA
(703) 941-0525

WASHINGTON
(503) 283-0132

WEST VIRGINIA
(216) 442-8080

WISCONSIN
(414) 544-6042

WYOMING
(503) 283-0132

CANADA
Ontario
(416) 671-3920 or
(613) 726-8888
Quebec
(514) 336-0392
British Columbia
(604) 430-1410
Ottawa
(613) 726-8888
Montreal
(514) 336-0392

7/86
Rev. 1

RACAL-DANA Instruments Inc.

U. S. AND CANADIAN SERVICE CENTERS

FACTORY SERVICE

A

RACAL-DANA INSTRUMENTS INC.
4 Goodyear Street
Irvine, California 92718
Telephone: (714) 859-8999

PRODUCT SERVICE TWX 910-595-1136

REGIONAL SERVICE CENTER

B

RACAL-DANA INSTRUMENTS INC.
5101 "D" Blacklick Road
Annandale, Virginia 22003
Telephone: (703) 941-0525

INTERNATIONAL SERVICE CENTERS

RACAL-DANA INSTRUMENTS LTD.

Hardley Industrial Estate, Hythe,
Southampton, Hampshire, S04 6ZH, England
Telephone: (0703) 843265, TLX: 47600

RACAL-DANA INSTRUMENTS GmbH.

Hermannstrasse 29, D-6078 Neu Isenburg,
Federal Republic of Germany
Telephone: 06102-2861/2, TLX: 412896

RACAL-DANA INSTRUMENTS S.A.

18 Avenue Dutartre, 78150 Le Chesnay, France
Telephone: (1) 3-955-8888, TLX: 697 215

RACAL-DANA INSTRUMENTS ITALIA srl.

Via Mecenate 84/A, 20138 Milano MI, Italy
Telephone: (02) 5062767/5052686, TLX: 315697

REPAIR REQUEST FORM

To allow us to better understand your repair requests, we suggest you use the following outline and include a copy with your instrument to be sent to your local Racal-Dana repair facility.

Model Number _____ Options _____ Date _____

Serial Number _____ P. O.# _____

Company Name _____

Address _____

City _____ State _____ Zip Code _____

Contact _____ Phone Number _____

1. Describe, in detail, the problem and symptoms you are having.

_____

_____

2. If you are using your unit on the bus, please list the program strings used and the controller type, if possible.

_____

_____

3. List all input levels, and frequencies this failure occurs.

_____

_____

4. Indicate any repair work previously performed.

_____

_____

5. Please give any additional information you feel would be beneficial in facilitating a faster repair time. (I. E., modifications, etc.)

_____

_____

MP MASTER
MA31102